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ON THE STEAM-ENGINE.

(CONTINUED.)

Having in our former papers ascertained the true constitution of steam, we shall henceforward be enabled to apply it in the best manner to produce motive power, as it evidently ought to be applied: comparing and correctly distinguishing its effects within the different kinds of engines in which it has been usually employed, namely, *low-pressure engines*, or those in which the piston is uniformly impelled the whole stroke by steam little exceeding in density the atmosphere, while resistance is removed from the opposite side of the piston by condensation of the steam; *high-pressure engines*, or those where the piston is driven with a uniform force the whole stroke, by steam of much greater density than the atmosphere, the opposite side of the piston being relieved by the steam escaping without condensation; and *expansive engines*, or those in which the piston is impelled some distinct part of the stroke by expanding steam alone.

If we thus far extend our views, the general and proportional efficiency of steam within engines will be fully exhibited, and the best method of applying it will thence become so very apparent, that the methods commonly preferred and practiced will appear in general as strangely erroneous as they are alike extensively and deeply injurious to many important and increasing interests.

If in a high-pressure engine, (which we shall denominate A for the sake of future reference) we employ steam of the density of four atmospheres, or with a pressure of 60 lbs. per square inch, its effective force upon the piston will be three atmospheres only; because the steam, in its exit from the cylinder, reäcts against the piston with a force of one atmosphere: hence the effective pressure of the steam is reduced to 45 lbs. per square inch.

If in a low-pressure engine, (which we shall call B) we employ steam of the density of one atmosphere, or with a pressure of 15 lbs. per square inch, the same absolute quantities of water and heat that were employed to form steam of 60 lbs. per square inch in the preceding high-pressure engine, will supply a low-pressure engine of four times the capacity with steam of 15 lbs. per square inch; and as the piston will be resisted by the reaction of steam of about 1 lb. per square inch in the vacuum so called, the actual effective pressure of the steam is reduced to 14 lbs. per square inch; but as the area of the piston is four times as large as in the high-pressure engine, so the effective force of the steam upon it is as proportionally greater as 56 to 45; and the low-pressure engine would be of course the most powerful in that proportion, were it not that in a low-pressure engine an allowance must be made for an additional load upon the engine, resulting in the power employed in working the air and hot-water eduction pump, and in working the cold-water pump. For this reason, the aforesaid balance in favor of B will be varied with local circumstances, and be considerably reduced in large engines, while in small ones it may be annihilated.

Hence, then, it is oftentimes a nice matter to discover which description of engine, A or B, will perform the most work with the same value of steam; and again we see what time has been wasted in discussions and fruitless disputations as to which is the more powerful engine of the two; and how much more advantageous it would have been for mankind, had the talents and leisure of the disputants been employed in extending or perfecting the improvements in both, rather than in pertinaciously claiming unwarranted superiority for either; nourishing

useless and pernicious prejudices; neglecting reason, the light of science, and good example.

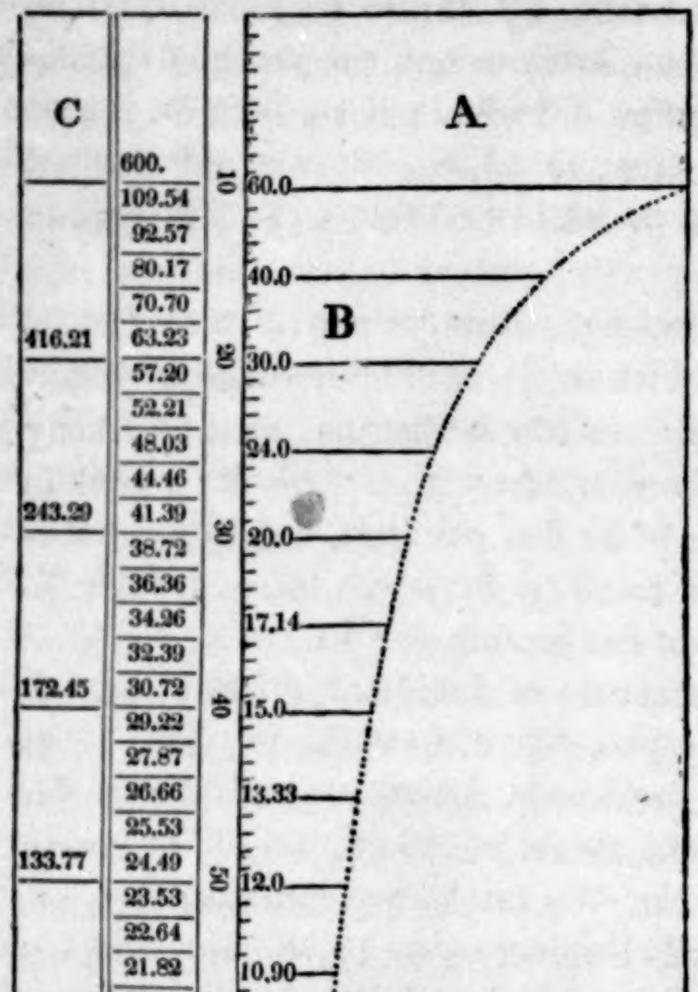
How far a neglect of these has been injurious will be apparent, if we observe that high steam, when expanded, is not lost, but merely becomes low steam; and that low steam, propelled from high-pressure engines, though so generally and carelessly wasted, still remains as powerful and as valuable as was the high steam employed, were it but properly applied in a suitable engine. It is evident from this that steam which has propelled any high-pressure engine, as A, may be just as advantageously again employed to propel one of low-pressure, as B; equal in power to A, because the area of B may always be so proportioned to the density of the steam in A as to secure its full efficiency. Hence, again, the converse follows: the steam required for a low-pressure engine may be generated of greater density, and first used to propel a high-pressure engine previous to its employment in one of low-pressure.

Now, as steam can be practically employed twice in succession, should we choose, it can thus be always doubled in value, for two results can be obtained with one expense, and a great economy be thus effected wherever a sufficient supply of cold water can be obtained for condensation of steam, when again employed in a low-pressure engine.

What a complete contradiction is produced by this valuable result to overthrow all Mr. Palmer's assertions! showing, as it does, that the powers of all existing low-pressure and high-pressure engines may be doubled without expense, his very great authority against it notwithstanding. What a splendid lesson does it furnish to the confused, dull and tiresome advocates of the present ineffective low or high-pressure engines, in which the mere successive employment of steam alone is here undeniably shown to produce, in the joint use of those engines, double the power that can be produced by them if but singly employed as at present, and which employment is so advocated and so lauded, and in such a haughty tone of defiance, by Mr. Palmer, as and perfectly unsurpassable!

The actual power to be gained by the expansion of steam within a heated cylinder, maintained at a constant temperature,

is shown in the annexed diagram and table, wherein the space A represents the quantity of high steam expanded; the space B, inclosed and bounded by the parabolic curve, represents the proportional additional power gained by the expansion of the steam in A, through the respective portions of B, in which the ordinates represent the decreased density of the expanded steam, corresponding with and consequent upon its expansion.



The table C shows the calculated value of each area of the fifth of a volume of the high steam employed, and represents the actual gain, which may be thus ascertained by inspection. For example: Assuming the value of the high steam as 600, and when an equal volume of the steam has been cut off, as at half stroke, the gain is 401.23; when cut off at one-third stroke, the gain is 659.50; and so tabulated for any portion, to one-tenth of the stroke.

In the diagram, the high steam admitted to be expanded is assumed of the density of 60 lbs. per square inch; but the pro-

portional gain, by the expansion of steam of any other density, may be obtained from the table by simple proportion, because the expansive value of steam is a constant proportional quantity. Thus: If the value of steam of 85 lbs. per sq. inch be required when twice expanded; then, as 60 lbs. is to the tabular value of 659.50, so is 85 lbs. to 93.44+85=178.44; the value required.

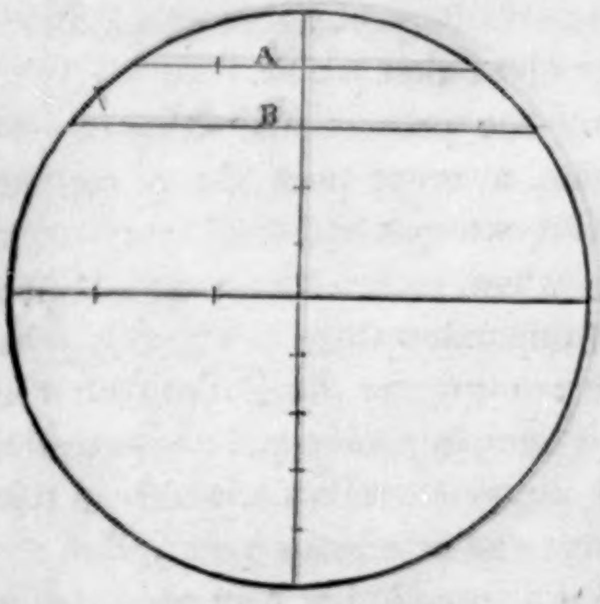
Again: the average steam pressure of any area of the table C may also be easily and correctly found, by dividing the sum of the area whose average is sought by the parts included in the centisimal scale of the diagram within the area. Thus, the sum of the area of steam of 60 lbs. per inch, cut off at one-sixth stroke, is 1674.67, and divided by 60 parts, the sum 27.9 is the average steam pressure of the section sought.

Again: the average pressure of incipient steam of any other density may be found by proportion, from the previous process. Thus, as 60 is to 27.9, previously found, so is 43.25 to 20.11, the true value of incipient steam of 43.25, cut off at one-sixth stroke, though given in Mr. Wickstead's communication, in the 2d Vol. Trans. Inst. Civil Engineers, as 17.66 only, and which erroneous calculation affects his description of the value of a Cornish engine in no inconsiderable degree, as we shall more particularly state in a future notice of that paper.

Having thus ascertained the true proportional value of expanded steam, we perceive what a great accession of power may seemingly be thus obtained without expense, and as it really may be, to a very great extent, in the pumping engine; because steam, however much expanded therein, provided its elasticity still continues to exert a greater force than all the friction of the engine and of the pumping machinery united, the motive power of the steam still remains available, which in this kind of engine is appended to one end of a lever beam, from the opposite end of which the load is suspended. Any power thus applied acts with its full effect at all parts of the stroke, as the load is always reäcting with a uniform leverage, just as a weight in one scale acts on the weight in the opposite scale of a common balance: hence, the full effect of steam decreasing in intensity is limited alone by the friction of the engine and ma-

chinery. But in rotary or crank engines, a much earlier limit obtains, from the nature of the crank itself, combined with the rapid decrease of the expanding force of steam; and this limit has been found of so much actual consequence in these engines as to have caused many engineers to hazard the assertion that the expansive force of steam could not be advantageously employed therein. And the assertion is not made without some show of reason; because this expansive force cannot be practically employed to either the same extent or to the same advantage, in rotary as in pumping engines; yet as it can be employed in them to a highly useful extent, it is very desirable and very important also, to ascertain with some tolerable precision what that extent actually is.

We shall now endeavor to show by the annexed diagram, with the aid of our former one, why the power of expanding steam cannot be employed as effectively in rotary as in pumping engines, and what degree of power can be obtained in the former; and though our proofs, to be practical and popular, will not be strictly precise, yet they will be sufficiently so for the sole purpose for which they are here produced, to explain the useful and important facts under immediate consideration.



Let the path of the crank-pin be represented by the circle in the diagram, and the descent of the steam-piston by the perpendicular diameter divided into 10 equal parts. Let us now suppose high steam admitted on the piston, to be cut off at a small part of the stroke, as recommended by non-practical theoretic writers. We assume one-tenth of the stroke, in accordance with such recommendations, and as conveniently affording chords of whole numbers.

Now, the load of a paddle-wheel, or of any other machinery driven by a crank engine, being constant, may be represented by the radius of the circle =5; and during the descent of the

piston through one-tenth of the stroke, the average effective leverage of the crank has been just half that of the semichord A=3: hence, the effective leverage of the crank has been, during this portion of the stroke, =1.5, or three-tenths of the radius only; it is evident the value of this, the most effective part of the motive power, the force of the unexpanded high steam, is reduced in the ratio of 10 to 3.

The semichord B being =4, during the descent of the piston the next one-tenth part of the stroke, it is evident the leverage of the expanding steam is as 3.5 to 5.0=the radius; and the value of this, the most effective portion of the expanding steam, is reduced in the proportion of 10 to 7.

In this great loss of power, or little effect from the small leverage of the upper portion of the crank during the rapid expenditure of the most effective portion of the steam, exhibited in the upper part of the diagram and parabolic curve, we may perceive sufficient cause for the great difference that is found between practice and the assumptions of theoretical writers.

We shall now attempt an explanation of facts, as fully as we can, as we shall at a future period find it exceedingly essential, and involving consequences of the first importance in our view of the future and full improvement of the steam-engine. Our observations on this particular subject are deduced from the long by-gone experience of more than twelve years, in working a powerful condensing, double-acting crank engine, impelled by expansive high steam, and constructed on purpose to test, and in hope of realizing, our expectations and views, which in a great measure resembled those now or recently held by Professor Renwick; as well as other essential improvements of the steam-engine, which will be fully explained hereafter, as they have proved of singular utility in steam navigation, and will contribute much to the future general improvement of the steam-engine. The engine, and machinery attached to it, afforded the fullest opportunity for correctly investigating the amount of work done at different times and under different circumstances.

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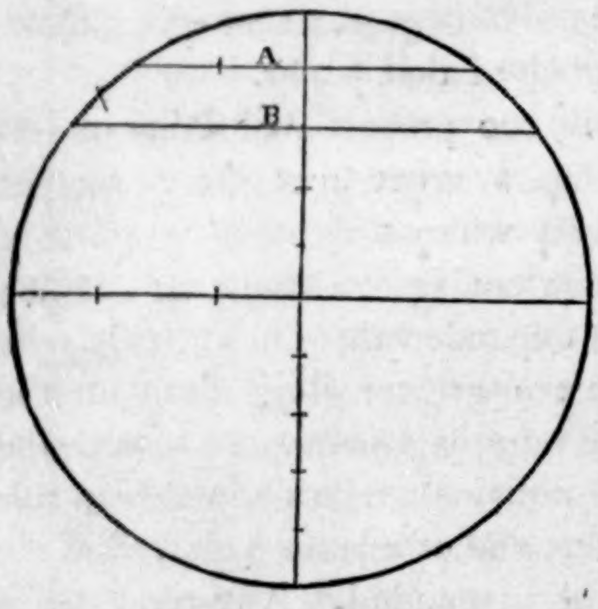

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closing the induction steam passages completely, at $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$ of the stroke, the eduction passages for steam being open nearly the whole stroke; when it soon appeared that $\frac{1}{5}$ was useless; $\frac{1}{2}$ and $\frac{1}{4}$ each much less useful than $\frac{1}{3}$, which was very superior to all others, and very effective.

Subsequently the slide was operated the whole stroke, by a common eccentric movement, and the high steam cut off by a small expansion valve; and again in these altered circumstances, as far as could ever be observed in numerous trials, the maximum effect of the steam producing the greatest efficiency of engine was obtained by cutting off the steam at one-third the stroke. Now, in both cases the really true internal abscission, had an indicator been applied to test it, was probably a little earlier than one-third; and as the motion of the steam-piston was at that portion of the stroke accelerating, and the motion of the slide retarding, the steam was somewhat expanded, (or wiredrawn) as the slide or valve closed: hence, then, a small portion of the estimated quantity of high steam may have been, and probably was deficient.

With this small reservation, the cutting off steam at one-third was found very superior to all other proportions for efficiency and economy; and whenever we have since had opportunities of comparing the work performed by a crank engine with the period for cutting off the high steam, we have found our former experience confirmed, and which, it may be seen, is also equally confirmed by the Cornish practice, where the happy application of expansive steam in pumping engines has been unsurpassed, and where the same talent and persevering industry has been employed to perfect the crank engine.

It appears in Mr. Wickstead's paper, in the 2d vol. Trans. of Inst. Civil Engineers, page 65, in a very improved double crank engine, for breaking ores at the Tincroft mine, the steam was cut off at two-fifths the down stroke, and at one-third the up stroke, and the duty exceeded 56,000,000 lbs. lifted one foot high, with one bushel coals. Now, as this duty of 56,000,000 lbs. performed by a stamping or rotary engine, impelled by expansive steam, is hailed as an extraordinary performance, and in the same paper in which Mr. Wickstead reports a pump-

ing engine to have performed nearly 118,000,000 lbs. duty, or more than double the duty of the best Cornish crank engine, the fullest confirmation is thus given of the great loss of power, or rather of the lesser power of expansive steam in crank engines—the causes and limits of which, hitherto neglected, we have endeavored to explain.

It may be as well here to observe, that in our engine the slide and valve were each so accurately fitted as effectually to close the passage for high steam at the periods stated ; and this observation becomes necessary, from the different and common practice here of employing that ineffective contrivance, the throttle valve, for that purpose, which by only partially closing the passage for high steam, allows some to pass even at first, but admits a considerable quantity to pass towards the termination of the stroke. From the general imperfect nature of these valves, and their coarse construction, the steam becoming much expanded within the cylinder, on one side of the throttle valve, and remaining of great density on the other side, rushes through it with immense velocity towards the termination of the stroke, and the effect of all steam thus admitted to pass, it is well known is much misapplied.

Returning from this digression to our subject—the value of expansive steam—which having been found of full efficiency when cut off at one-third stroke, we are able to ascertain correctly, by the aid of our table, the real gain by expansion, and thus to rightly distinguish between the absurd *no gain* of Mr. Palmer, and the equally enormous and unwarranted assumptions of Prof. Renwick ; and we thus are reasonably and satisfactorily assured that the gain by this process alone really equals or rather exceeds the original value of high steam, when used unexpansively in crank engines, while the steam still remains just as applicable to any other useful purpose, as of heating, drying, warming, or ventilating, as before, still remaining the same definite compound of water and of heat, of enlarged volume only—still unaltered in its chemical constitution ; and still as efficient for propelling a low-pressure steam-engine as steam of equal density generated for that particular purpose alone.

We may sum up these remarks, intended for illustration only,

by observing:—1. If from a given quantity of high steam a proportionate power is obtained, as commonly it is in this country in an unexpansive high-pressure engine, double that power may be obtained from the same steam in an expansive engine; and a further equal increase of power may be obtained from employing the same steam, subsequently to propel a low-pressure engine; so that, in general terms, we may double the power of the high steam by using it expansively, and treble its power by again using it in a condensing engine.—2. The converse of these propositions must be equally true—that steam, as commonly employed in low-pressure English engines, and as advocated by Mr. Palmer as unsurpassable, may be first previously employed to propel a high-pressure engine, or an expansive high-pressure engine, and thus made to furnish an equal power, or a double power, previous to again employing as profitably the same steam as in Mr. Palmer's inimitable. Thus, probably, may almost every factory engine in existence, every locomotive that runs, or steam-boat that floats, be improved in one or more of those important particulars—either in economy, power, or safety.

That much more than all this has been done in the Cornish pumping engines, is well known, and we have shown why it can be so done; and in our next we will endeavor, by an analysis of the properties of the pumping engines, to show why a much greater duty may be reasonably expected from them than has yet been reported, and extending our remarks to the general employment of expansive engines in the steamers of this section of the United States, we shall show that these engines are as unaccountably avoided, by the unwarranted prejudices of the English engineers, as they are here rendered unnecessarily hazardous.

From the positive and undeniable facts brought forward, each susceptible of easy and distinct proof, what a mean view must we not take of the inefficient, extravagant, and dangerous modes commonly employed for obtaining motive power from steam, merely from a disregard, amounting to almost total neglect, of contingent advantages, that would as extensively benefit society as greatly add to the honor of the national character!

For, after all these separate, distinct and repeated uses of steam, even after it has been condensed in a low-pressure engine, no portion of the heat has even then become latent, or hidden, or lost, but still remains sensible and apparent—is still to be all found in the warm or hot water flowing from the engine; and what is of more consequence, may still be again employed to great advantage and considerable profit in cities or other populous places, where the now extended use of steam might and ought to be employed to procure inestimable advantages to society, by furnishing unlimited means of cleanliness, with increased comfort and health, by an abundant, constant supply of tepid and warm baths, at such a trifling expense as would secure their free use to the whole population. Thus all classes, however humble, might enjoy this comfort, pleasure, and inexpensive luxury, at present unknown even to the most opulent, and from which they are alone debarred by penury of thought. † †

For the American Repertory.

ON THE EFFECTS OF ARTS, TRADES, AND PROFESSIONS, AS WELL AS HABITS OF LIVING, ON HEALTH AND LONGEVITY.

BY CHARLES A. LEE, M. D. NEW-YORK.

No. III.

In the further prosecution of our task, it will facilitate our labors to treat of the different topics which naturally come under consideration, under certain general heads or classes; as it will be impossible to notice in detail the effects of each individual art, trade or profession on health and longevity. In forming such an arrangement, we shall follow with some modifications the plan laid down by Ramazzini, which is founded on the nature of the causes producing the diseases to which artisans are liable. And there is the less occasion to go into detail, as many of the arts which have attained a high importance in other countries, are pursued to a very limited extent in our own; and the manufacturing processes which are decidedly detrimental to health among us, are as yet comparatively few.

These, as well as the minor trades, will fall under some of our general divisions.

The causes of disease among artisans may be arranged under three classes:

I. The first class consists:—1. Of *confinement* and *insufficient ventilation*.—2. Of *undue exertion*.—3. Of *sedentary habits*.

II. The second class comprehends:—1. *Undue exertion of particular parts*, and *insufficient exercise of other parts*.—2. *Unnatural or constrained positions in different employments*.—3. *Temperature and moisture*.

III. The third class embraces those causes which consist of material molecules, and which, coming directly or mediately in contact with the body, in the state either of vapor or of minute disintegration, penetrate the organs and disorder their functions. These are:—1. *Mineral molecules*.—2. *Vegetable molecules*.—3. *Animal molecules*.—4. *Mineral and vegetable molecules acting mechanically*.

Class First.—The deleterious influence of *confinement* and *insufficient ventilation* would seem so obvious, as scarcely to need remark; and yet there is no cause of disease so general, and so extensively overlooked and neglected as this. Our dwellings, school-rooms, theatres, churches, assembly rooms, laboratories, manufactories, hospitals—all testify to the truth of this remark; for nearly all are constructed without adequate provision for ventilation. Our architects seem to have studied anything but our health and comfort; as if convenience, and symmetry of proportion, and elegance of decoration, were only to be sought, and were incompatible with free ventilation. In manufactories, especially, do we find those employed suffering greatly from this cause. As the rooms are usually heated by air or steam conveyed in pipes, the air is not renewed with that rapidity which obtains in apartments furnished with open fireplaces; and the consequence is, that the inmates are constantly breathing large quantities of animal effluvia and carbonic acid gas, both of which are poisonous.

The importance of free ventilation will appear from the statement of a few simple facts.

The object of respiration is to bring the oxygen of the air in

contact with the blood, by which the latter is deprived of its carbonic acid, and absorbs a new supply of oxygen. When the atmospheric air is taken into the lungs, it consists of about 79 per cent of nitrogen, and 21 per cent of oxygen, and nearly 1 per cent of carbonic acid: when it is expelled, it is found to have lost about 9 per cent of its oxygen, the place of which is supplied by an equal amount of carbonic acid. At the same time the blood has undergone an important change, from a dark purple hue, unfitted for the support of life, to a florid red color, carrying health and vigor to every fibre of the body.

It is not our purpose to inquire into the manner in which these changes are effected: it is sufficient for us that they are produced, and that they are absolutely essential to the existence of animal life.

As the rapidity with which the air is vitiated is not generally known or appreciated, the following calculations may not be unimportant: An individual breathes, on an average, from 14 to 20 times in a minute, and inhales from 15 to 40 cubic inches of air at each inspiration. According to Southwood Smith, it appears that in one minute an individual requires 616 cubic inches, or about 18 pints of air; and that during the same space, 24 cubic inches of oxygen have disappeared, and been replaced by a like amount of carbonic acid; so that in one hour each adult person vitiates the air by the subtraction of 1440 cubic inches of oxygen. In one hour, the quantity of air inspired amounts to 2 hogsheads, 20 gallons, and 10 pints; in one day, to 57 hogsheads, 1 gallon, and 7 pints; and during the same period of time, 24 hogsheads of blood, or 1 hogshead each hour, and 144 ounces each minute, are sent to the lungs, to undergo the change already pointed out. Supposing 1 pint of air to be inhaled at each inspiration, which is very nearly the quantity, the amount decomposed is about one-fourth, or a quarter of a pint; so that each individual actually vitiates or poisons one-fourth of a pint of air every time he breathes. The rapidity with which this deteriorating process goes on is very clearly shown by placing a mouse under a large tight glass jar, full of air. In a few moments it becomes uneasy, pants for breath, and in a short time dies in convulsions.

There is another cause of deterioration of the air, not generally taken into account, which is of considerable importance. An adult gives off, by insensible perspiration, from 12 to 30 grains of vapor per minute; and it is ascertained that the air which has been sometime in contact with the skin, becomes chiefly carbonic acid gas. Tredgold states that it is desirable to change as much of the air of a room as the moisture given off would saturate in the same time. Accordingly, in a room at 60°, on the supposition, which is probably very nearly correct, that the moisture given off amounts to 18 grains, it will be necessary to change three cubic feet of air per minute for each individual in the room. If the temperature of the room be high, the exhalation of course will be in proportion.

Our rooms and public halls have also to be lighted at night; and here is another source of deterioration of the air. Each gas-burner is found to consume as much oxygen as 8 candles, and each candle renders about 300 cubic inches of air unfit for breathing every minute; so that 2 candles deteriorate the air as much as 1 individual. The total quantity of air, then, which will be vitiated by these causes, for each person, will be—

By respiration,	800	cubic inches per minute.
By exhalation,	5184	" " "
By lights,	432	" " "
Total,	6416	cubic inches, or nearly 4 cubic

feet per minute. It is necessary, therefore, in order to preserve the purity of the air, that the above quantity should be changed every minute. For example: If a room contains 200 people, there should be 800 cubic feet of air changed every minute, or more than would fill a room 9 feet square and 9 feet high; 400 people will require 1600 cubic ft. of fresh air every minute. From the above estimates, any person may calculate the rapidity of deterioration in a close room of given dimensions, occupied by a given number of individuals.*

* Tredgold gives the following rule for determining the area of tubes for ventilation: "Multiply the number of people the room is to contain by 4, and divide this product by 43 times the square root of the height of the tubes in feet, and the quotient is the area of the ventilator tube or tubes in feet."

By the height of the tubes is to be understood the height from the floor of the room

And now, what are the means of ventilation adopted in our private dwellings, and our public halls, schools, theatres, and churches? Can any one doubt that, for the most part, they are totally inadequate to a free and proper ventilation? Most of them have no provision, except the doors and windows, for the admission of pure air, and the escape of that which is impure; and the consequence is—headaches, dullness, vertigo, indigestion, debility, and a train of painful and disordered actions and sensations. We have long believed that the foundation of a large proportion of our chronic, and many of our acute diseases, is laid in the respiration of a vitiated and impure atmosphere; for as healthy blood is the ordained stimulus and pabulum of every organ and fibre in the animal system, and as there can be no healthy blood except from the contact of pure air, it necessarily follows that derangement of function and defect of nutrition must be the consequence of inhaling such an atmosphere.*

In no instance is the truth of this remark more strikingly displayed than in our schools and academies, especially boarding schools. It would seem that our teachers believe in the total independence of the mind upon the body, and that their pupils are purely intellectual beings; and being thus spiritual, are not influenced by the organic and physical laws which con-

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to the place where the air escapes to the external atmosphere; and they must all be of the same height, when more than one. The spaces for admitting fresh air should be near to the floor, or in the floor of the room, and should be nearly of the same size as the ventilator tubes. Some think, however, that they should be at least double the size, in order to avoid the rapid influx of cold air. In a room ventilated in this manner, an open fire is inadmissible.—(*Tredgold on Warming and Ventilating Buildings, p. 77.*)

* It should be recollected that this, like most of the causes which destroy health, acts in a very slow and gradual manner. Changes, however, are at length produced, which become visible in the altered appearance of the individual; but the cause is too generally overlooked. Owing to the renovating power of the constitution, an occasional exposure to a heated and crowded room may be borne, perhaps, with impunity; whereas the daily breathing of such an atmosphere, as in a school or manufactory, effects deep-seated and certain changes, which at no distant period will manifest themselves. It is in this way that the foundation of consumption (which carries off one-sixth of our population) is laid, as well as that host of protean nervous ailments with which our females are so generally afflicted.

trol animal bodies. Whether this be the case or not, they certainly seem to act on such a belief; and we do not expect to witness any reform, until physiology becomes, as it long since should, a branch of general study, and considered absolutely indispensable to all who have anything to do with training the minds or bodies of the young. In our boarding schools, not one girl in ten who has been an inmate for the space of twelve months, enjoys good health; and a still less proportion than this escape without a distortion of the spine. This has usually been attributed to want of exercise, and sitting upon stools without any support to the back; but we believe that breathing a vitiated atmosphere lays the foundation of the evil, by depriving the blood of its usual proportion of fibrine, thus rendering the muscles soft and flabby, and depriving them of their healthy contractility.

There is indeed no evil in our country which calls more loudly for reform than the custom of herding large numbers of children in a single room, for the ostensible purpose of education, without any proper provision for warming and ventilation. It will be seen from data already given, that in a room 16 by 24 feet, 35 children will render the air unfit for breathing in 45 minutes. If the room be 30 feet square and 9 feet high, and if there be 50 scholars, in 40 minutes all the air of such a room will have become contaminated, if fresh supplies be not provided, without taking into account the production of carbonic acid by exhalation from the surface. And yet, until within a short period, none of our country or city school houses were furnished with ventilators, and the pupils were flogged for sleepiness and mental inactivity caused by the very air they were incessantly compelled to breathe.

Massachusetts has taken the lead in the reformation of this evil, as she has in almost every other of a public nature. In the Eliot school-house, North Bennet street, Boston, for example, the rooms are heated by furnaces placed in the cellar, and the heated air constantly circulates through the rooms, and is carried off by six large ventilators. A writer in the Common School Journal states, that "so efficient is the circulation of the air, that at the opening of the new house, when 470 were assembled

in one room to listen to an address from the Mayor, though the room was thus crowded for more than two hours, yet no oppressive sensation was experienced; respiration was free and easy, and the pupils as lively and animated as in the open air. I believe the pupils seen in the new school room would not be recognized as the same boys who were cooped up in Baldwin-place vestry for six months, till their mental and moral depreciation had nearly destroyed their identity." Where anthracite coal can be obtained, school-houses should be warmed by furnaces placed in the cellar, or by Olmstead's stoves; or where there are several rooms, by hot water conveyed in pipes; and the ventilators in the lower rooms should be placed next to the ceiling overhead, and in the upper, a little way from the walls. We need not add that they should be sufficiently numerous to keep up a constant purity of the air; for if the supply of pure air be in the least degree below the supply of that which is foul, the health of the scholars must inevitably suffer in that proportion. The air for ventilation, however, should be taken from out of doors, and not from a cellar, although this answers well enough for warming. To show the influence of bad internal arrangements and bad locations for school houses upon the health of the pupils, a physician of Massachusetts during the last year took measures to ascertain with exactness the relative amount of sickness suffered by the children in two annual schools. The schools were selected on account of their proximity, being but a short distance from each other: they consisted of very nearly the same number of children, belonging to families in the same condition of life, and no *general* physical causes were known to exist which should have distinguished them from each other in regard to the health of the pupils. But one house was dry and well ventilated; the other damp, and so situated as to render ventilation impracticable. In the former, during a period of 45 days, 5 scholars were absent, from sickness, to the amount in the whole of 20 days: in the latter, during the same time, and for the same cause, 19 children were absent, to an amount in the whole of 145 days; that is, almost four times the number of children, and more than seven times

the amount of sickness, indicated a marked difference in their condition as to health.*

The public schools in this city also are very poorly ventilated; for, though the rooms are generally large, yet from the great number of scholars, often numbering 5 or 600, the air becomes excessively impure and oppressive. Whoever has been in the habit of entering these rooms at different periods of the day can not but have noticed the great difference in the air, and even the altered appearance of the inmates. The sprightliness and activity of the morning have been succeeded by weariness, languor and fatigue, long before the hour arrives for their liberation. The same tedious routine is pursued day after day; and the only wonder is that the result is not invariably bodily disease and mental imbecility.

We shall say nothing of subterranean apartments for religious meetings and Sabbath schools; nor of ball-rooms and theatres, with their scores of lamps and gas-burners: public attention has been too often directed to the evils connected with them to render any remarks from us necessary. As to our prisons and penitentiaries, as they are expressly designed for the punishment of culprits, it can hardly be expected that health or comfort should be consulted in their construction; accordingly, we find that they are made as air-tight as possible, in order, probably, to the more complete accomplishment of the objects for which they were designed!†

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* Common School Journal.

† For example, we may refer to nearly all the prisons and public buildings of this city and vicinity. Mr. Combe, in his late lectures on phrenology in this city, remarked while treating of this subject as follows:—"To afford sufficient quantity of fresh air in churches, schools and lecture rooms, is very important. If they are not well ventilated, the brain is oppressed, and cannot of course act with clearness and energy. Dr. Reid, who was employed to ventilate the houses of Parliament, considered it necessary to supply 10 cubic feet of air a minute for each person they were adapted to accommodate. This air is sent in of proper temperature. The effect of bad air we see this evening. This hall is crowded to excess, and there are no adequate means of ventilation; hence the faintness to which a number have been subject; two or three ladies have had to be led out. We have done much to reform matters in our own country, though we have had an arduous task. There is still much to be done, however; and you have much to do in this country in your public halls and schools." Again:—"On visiting your public schools, I find you have no adequate provision for fresh air. Recollect the air must be warmed before being

MECHANICS' VADE MECUM.

No. IV.

The lavish use or misapplication of materials, in the art of building in this country, has arisen not less from the superabundance of the natural products used in architecture than from a want of knowledge as to their strength or cohesion. The observations and experience of the practical builder, valuable to himself only after the devotion of years to his business, are useless to all others, as they constitute a species of knowledge that cannot be communicated—a feeling of fitness that cannot be described; and few persons have had the facilities, the leisure, and inclination for conducting a series of experiments to test the strength of such materials as are mostly used for the construction of our habitations, and more particularly those employed in carpentry. The little that has been proven and placed upon record relative to the strength of timber obtained from our forest trees is so diffused and unsystematic as to render it almost unavailing to the architect, nor can he with any confidence use the results, accurate as they are, of experiments upon European woods, since these are so dissimilar in their constitution to the

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let into the room. If you attempt to ventilate by throwing open the windows, you expose the children to the danger of taking cold, from which much injury must ensue. Should there be now listening to me any member of the civic Corporation, I would recommend this subject to his special attention. Seeing the great importance of good air to all—young and old, healthy and diseased—what would you think were I to tell you that the new Lunatic Asylum on Blackwell's Island has been built at an immense expense, and no provision made for a supply of fresh air, the importance of ventilation being entirely overlooked? Yet such is the fact. On going through it, I pointed out this great oversight. A gentleman, distinguished for his enlightened interest in public improvements, suggested that as the plaster was two inches from the wall, a sort of flue might be formed behind it. But for this fortunate suggestion, the means of ventilation would have been entirely absent. I would ask any member of the City Council who may be here present, whether he has seen the pauper school on Long Island? If he has not, I advise him to go and examine the size of the rooms; inquire how many children sleep in each, and what means of ventilation exist. Having done this, let him reflect and decide for himself whether the state of things in these respects is not the cause of opthalmia and other diseases."—*(Mr. Combe's Lectures on Phrenology, reported by Dr. Boardman.)*

woods in use with us for like purposes as to make any estimates of the strength of the one apply to the other, to say the least, extremely hazardous. We look forward to a more perfect organization of the U. S. Civil Engineer corps as an event that will bring in its train many important results to science; and not the least of these will be a full knowledge of the properties of American timber.

Many of the remarks, preceding a table of the strength of cast iron beams given in the 2d No. of this series of papers (see Vol. I, No. 6, of the Am. Repertory) illustrative of the several kinds of strain to which materials are subjected when used in architecture, are applicable to the subject of the present paper: that is, the strength of rectangular beams of fir, spruce, oak, &c. when submitted to a *pressure* not reaching the point of injury to their elasticity: and the rules appended to the former table for determining the load the beam will bear in differing circumstances will also apply to the accompanying Table B. In the Table of ratios A, the strength of red fir, although that wood is but little used in this country, is taken as unity, from its giving by comparison with cast-iron a table of amounts having fewer places of decimals than any other wood named by Turnbull, to whom we have again to acknowledge obligation. The numbers representing the strength of American timbers (†) are determined with the nearest approach to accuracy that the imperfect state of knowledge upon the subject, to which we have before alluded, permits. They will be found sufficiently correct, however, to be of great value; and if any error exists, it is on the side of safety.

TABLE A.—*Ratios of Strength.*

NAME OF THE WOOD.	BREADTH.	DEPTH.	STRENGTH.
Red or Yellow Fir	1.000	1.000	1.000
Ash	1.300	1.142	0.766
Beech	2.000	1.414	0.500
Honduras Mahogany	1.250	1.118	0.800
English Oak	1.200	1.096	0.833
†White Pine	2.000	1.414	0.500
†Spruce	1.875	1.335	0.533
†White Oak	1.250	1.118	0.800
†Georgia Pine	1.300	1.142	0.766

The numbers opposite any wood in the preceding table will give the breadth, depth or strength of a rectangular beam of that wood, by calculation from the numbers in Table B, as thus:

A beam of *white pine*, 5 inches broad and 16 inches deep, is placed horizontally on two supports, 24 feet asunder: How much will it bear at the middle of this distance, the elastic force remaining perfect?

In Table B, under 16 inches at the top of the columns, and opposite 24 feet in the margin, stands 1.212 tons for a beam 1 inch broad; and the strength is directly as the breadth; therefore, $1.212 \times 5 = 6.06$ tons for the strength of a beam of *fir* of the given dimensions. Now in Table A, opposite *white pine*, we have .5 as its comparative strength; therefore, $6.06 \times .5 = 3.03$ tons; the load required.

Again. A beam of *white pine* 16 inches deep and 24 feet between the supports, is found to bear 3.03 tons at the middle of its length while the elastic force remains perfect: What is its breadth?

In Table B, under 16 inches at the top of the columns, and opposite 24 feet in the margin, stands 1.212 tons for the strength of a beam 1 inch broad; therefore, $3.03 \div 1.212 = 2.5$ inches for the breadth of a beam of *yellow fir* of equal strength: then in Table A, opposite *white pine*, in the column marked *breadth*, we find 2.0; hence, $2.5 \times 2.0 = 5$ inches; the breadth required.

Again. A beam of *white pine*, 5 inches broad and 24 feet between the supports, is found to bear 3.03 tons at the middle of its length while the elastic force remains perfect: What is its depth?

Divide 3.03 by 5; then in Table B, opposite 24 feet, the given length, the nearest number to .606 is found under 11 inches at the top of the columns, which is the depth of a beam of *yellow fir* of equal strength: then in Table A, opposite *white pine*, in the column marked *depth*, we have 1.414; therefore, $1.414 \times 11 = 16.5$, or rejecting fractions, 16 inches; the depth required.

In practice, an abatement is made, generally one-third, from the tabular strength of beams, for the difference between what is termed merchantable timber and the specimens with which experiments have been performed to test the strength of the several woods. It will be observed that the weights in Table B refer to the strength of beams when lying loosely on the walls or supports; a condition that, for safety, should always be assumed unless the beam be very firmly secured in the walls.

TABLE B.—*Strength of Red or Yellow Fir Beams—Breadth one inch.*

Len. in feet.	DEPTH IN INCHES.								
	1	2	3	4	5	6	7	8	9
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1	0.114	0.453	1.023	1.821	2.844	4.098	5.577	7.284	9.222
2	0.057	0.228	0.510	0.909	1.424	2.049	2.787	3.642	4.711
3	0.039	0.150	0.333	0.606	0.948	1.365	1.857	2.427	3.075
4	0.027	0.114	0.255	0.453	0.711	1.023	1.392	1.821	2.204
5	0.021	0.090	0.204	0.363	0.567	0.819	1.113	1.455	1.842
6	0.018	0.075	0.171	0.303	0.474	0.681	0.930	1.212	1.536
7	0.015	0.066	0.147	0.258	0.405	0.585	0.795	1.041	1.317
8	0.012	0.054	0.126	0.228	0.354	0.510	0.696	0.909	1.152
9	0.012	0.051	0.114	0.201	0.315	0.453	0.618	0.807	1.023
10	0.009	0.045	0.102	0.183	0.285	0.408	0.555	0.726	0.921
11	....	0.042	0.093	0.165	0.258	0.372	0.507	0.660	0.837
12	....	0.039	0.084	0.150	0.237	0.339	0.465	0.606	0.768
13	....	0.036	0.078	0.138	0.219	0.315	0.429	0.558	0.708
14	....	0.033	0.072	0.129	0.204	0.291	0.396	0.519	0.657
15	....	0.030	0.069	0.120	0.189	0.273	0.372	0.486	0.615
16	....	0.027	0.063	0.114	0.177	0.255	0.348	0.453	0.576
17	....	0.027	0.060	0.108	0.165	0.240	0.327	0.426	0.543
18	....	0.024	0.057	0.099	0.159	0.225	0.309	0.405	0.513
19	....	0.024	0.054	0.096	0.150	0.216	0.294	0.381	0.486
20	....	0.021	0.051	0.090	0.141	0.204	0.279	0.363	0.462
21	....	....	0.048	0.087	0.135	0.195	0.264	0.345	0.428
22	....	....	0.045	0.081	0.129	0.186	0.252	0.330	0.417
23	....	....	0.045	0.078	0.123	0.177	0.243	0.315	0.399
24	....	....	0.042	0.075	0.117	0.171	0.231	0.303	0.384
25	....	....	0.042	0.072	0.114	0.162	0.224	0.291	0.369
26	....	....	0.039	0.069	0.108	0.156	0.213	0.279	0.354
27	....	....	0.012	0.066	0.105	0.150	0.207	0.270	0.342
28	....	....	0.012	0.063	0.102	0.147	0.198	0.258	0.327
29	....	....	0.033	0.063	0.099	0.141	0.192	0.252	0.318
30	....	....	0.033	0.060	0.093	0.135	0.186	0.243	0.306
31	....	....	....	0.057	0.090	0.132	0.180	0.234	0.297
32	....	....	....	0.057	0.087	0.129	0.174	0.228	0.288
33	....	....	....	0.054	0.087	0.123	0.168	0.219	0.279
34	....	....	....	0.054	0.084	0.120	0.165	0.213	0.270
35	....	....	....	0.051	0.081	0.117	0.159	0.207	0.264
36	....	....	....	0.051	0.078	0.114	0.153	0.201	0.255
37	....	....	....	0.048	0.075	0.111	0.150	0.195	0.249
38	....	....	....	0.048	0.075	0.108	0.147	0.192	0.243
39	....	....	....	0.045	0.072	0.105	0.144	0.186	0.237
40	....	....	....	0.045	0.072	0.102	0.138	0.180	0.231
41	....	....	....	....	0.069	0.099	0.135	0.177	0.225
42	....	....	....	....	0.066	0.096	0.132	0.174	0.219
43	....	....	....	....	0.066	0.096	0.129	0.168	0.213
44	....	....	....	....	0.063	0.093	0.126	0.165	0.207
45	....	....	....	....	0.063	0.090	0.123	0.162	0.204
46	....	....	....	....	0.060	0.087	0.120	0.159	0.198
47	....	....	....	....	0.060	0.087	0.117	0.153	0.195
48	....	....	....	....	0.057	0.084	0.117	0.150	0.192
49	....	....	....	....	0.057	0.084	0.114	0.147	0.189
50	....	....	....	....	0.057	0.081	0.111	0.144	0.183

TABLE B.—*Strength of Red or Yellow Fir Beams—Breadth one inch.*

Len. in feet.	DEPTH IN INCHES.								
	10	11	12	13	14	15	16	17	18
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons*	*Tons.*
1	11.385	13.773	16.392	19.239	22.314	25.614	29.142	32.901	36.882
2	5.691	6.798	8.196	9.621	11.157	12.807	14.571	16.449	18.441
3	3.795	4.593	5.466	6.411	7.437	8.538	9.714	10.965	12.294
4	2.847	3.544	4.098	4.809	5.577	6.402	7.287	8.226	9.219
5	2.277	2.754	3.279	3.849	4.461	5.121	5.844	6.579	7.377
6	1.896	2.295	2.733	3.204	3.717	4.269	4.857	5.484	6.147
7	1.626	1.968	2.343	2.748	3.186	3.660	4.164	4.698	5.268
8	1.422	1.722	2.049	2.406	2.787	3.201	3.642	4.113	4.611
9	1.263	1.530	1.821	2.136	2.478	2.844	3.237	3.654	4.108
10	1.137	1.377	1.628	1.923	2.232	2.562	2.913	3.288	3.690
11	1.035	1.251	1.381	1.749	2.028	2.328	2.649	2.991	3.354
12	0.948	1.146	1.365	1.602	1.857	2.133	2.427	2.742	3.075
13	0.876	1.059	1.260	1.479	1.716	1.971	2.241	2.529	2.838
14	0.813	0.984	1.170	1.374	1.593	1.830	2.082	2.349	2.634
15	0.759	0.918	1.092	1.281	1.488	1.707	2.041	2.193	2.457
16	0.711	0.861	1.023	1.203	1.395	1.599	1.821	2.055	2.304
17	0.669	0.821	0.963	1.131	1.311	1.506	1.713	1.935	2.169
18	0.633	0.765	0.912	1.068	1.239	1.322	1.617	1.827	2.049
19	0.597	0.726	0.864	1.011	1.173	1.347	1.533	1.721	1.941
20	0.567	0.687	0.819	0.960	1.116	1.278	1.435	1.644	1.842
21	0.540	0.654	0.780	0.915	1.062	1.218	1.386	1.566	1.755
22	0.516	0.624	0.744	0.873	1.014	1.164	1.323	1.494	1.674
23	0.495	0.597	0.711	0.834	0.969	1.113	1.266	1.428	1.602
24	0.474	0.573	0.681	0.801	0.927	1.065	1.212	1.371	1.536
25	0.456	0.549	0.654	0.768	0.891	1.023	1.164	1.314	1.476
26	0.438	0.528	0.630	0.738	0.858	0.984	1.119	1.263	1.419
27	0.420	0.510	0.606	0.711	0.825	0.948	1.077	1.218	1.365
28	0.405	0.492	0.585	0.687	0.795	0.915	1.041	1.173	1.317
29	0.393	0.474	0.564	0.663	0.768	0.882	1.005	1.134	1.272
30	0.378	0.459	0.546	0.639	0.734	0.852	0.969	1.095	1.227
31	0.366	0.444	0.528	0.621	0.717	0.825	0.939	1.059	1.188
32	0.354	0.429	0.513	0.600	0.696	0.798	0.900	1.026	1.152
33	0.345	0.417	0.498	0.592	0.675	0.774	0.882	0.996	1.116
34	0.333	0.405	0.483	0.564	0.654	0.753	0.855	0.966	1.083
35	0.324	0.393	0.468	0.549	0.636	0.732	0.831	0.939	1.053
36	0.315	0.381	0.456	0.534	0.618	0.711	0.807	0.912	1.023
37	0.306	0.372	0.444	0.519	0.603	0.693	0.786	0.888	0.996
38	0.297	0.363	0.432	0.504	0.585	0.672	0.765	0.864	0.969
39	0.291	0.351	0.420	0.492	0.573	0.657	0.747	0.843	0.945
40	0.285	0.345	0.408	0.480	0.558	0.639	0.726	0.822	0.921
41	0.276	0.336	0.399	0.468	0.543	0.624	0.711	0.801	0.897
42	0.270	0.327	0.390	0.456	0.531	0.606	0.693	0.783	0.876
43	0.264	0.321	0.381	0.447	0.519	0.594	0.678	0.765	0.858
44	0.258	0.312	0.372	0.435	0.507	0.582	0.663	0.747	0.837
45	0.252	0.306	0.363	0.426	0.495	0.567	0.645	0.729	0.819
46	0.246	0.297	0.357	0.417	0.483	0.555	0.633	0.714	0.801
47	0.243	0.294	0.348	0.408	0.474	0.543	0.618	0.699	0.783
48	0.237	0.288	0.342	0.399	0.465	0.534	0.606	0.684	0.768
49	0.231	0.282	0.333	0.393	0.453	0.522	0.594	0.672	0.753
50	0.228	0.276	0.327	0.384	0.444	0.513	0.582	0.657	0.738

Table B.—*Strength of Red or Yellow Fir Beams—Breadth one inch.*

Len. in feet.	DEPTH IN INCHES.								
	19	20	21	22	23	24	25	26	27
	Tons.	*Tons*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1	41.094	45.534	50.202	55.098	60.222	65.574	71.154	76.959	82.989
2	20.547	22.767	25.101	27.549	30.111	32.787	35.577	38.478	41.493
3	13.698	15.180	16.734	18.366	20.073	21.858	23.718	25.653	27.663
4	10.275	11.385	12.549	13.773	15.054	16.392	17.787	19.239	20.748
5	8.220	9.108	10.041	11.019	12.045	13.113	14.229	15.390	16.599
6	6.849	7.590	8.367	9.183	9.038	10.929	11.859	12.825	13.833
7	5.871	6.504	7.173	7.872	7.604	9.366	10.164	10.995	11.856
8	5.136	5.691	6.276	6.888	7.527	8.196	8.895	9.618	10.374
9	4.566	5.058	5.577	6.123	6.690	7.284	7.905	8.550	9.222
10	4.110	4.554	5.019	5.508	6.021	6.555	7.116	7.695	8.298
11	3.735	4.140	4.563	5.010	5.475	5.961	6.468	6.996	7.545
12	3.426	3.795	4.185	4.593	5.019	5.463	5.928	6.411	6.915
13	3.162	3.501	3.861	4.236	4.632	5.043	5.472	5.919	6.384
14	2.934	3.252	3.585	3.936	4.302	4.683	5.082	5.496	5.928
15	2.739	3.036	3.348	3.672	4.014	4.371	4.743	5.130	5.532
16	2.568	2.844	3.138	3.444	3.765	4.098	4.446	4.809	5.187
17	2.415	2.679	2.952	3.240	3.543	3.858	4.185	4.527	4.881
18	2.283	2.529	2.787	3.060	3.345	3.642	3.951	4.275	4.611
19	2.163	2.397	2.643	2.898	3.168	3.450	3.744	4.050	4.368
20	2.055	2.277	2.508	2.754	3.012	3.279	3.558	3.849	4.149
21	1.956	2.166	2.388	2.622	2.868	3.123	3.387	3.666	3.951
22	1.866	2.070	2.280	2.505	2.736	2.979	3.234	3.498	3.771
23	1.785	1.980	2.181	2.394	2.616	2.850	3.093	3.345	3.609
24	1.711	1.896	2.091	2.295	2.508	2.730	2.964	3.207	3.459
25	1.644	1.821	2.007	2.202	2.409	2.622	2.844	3.078	3.318
26	1.581	1.755	1.929	2.118	2.316	2.520	2.736	2.958	3.192
27	1.521	1.686	1.857	2.040	2.229	2.427	2.634	2.850	3.075
28	1.467	1.626	1.791	1.968	2.151	2.340	2.541	2.748	2.964
29	1.416	1.569	1.731	1.899	2.076	2.262	2.451	2.652	2.862
30	1.368	1.518	1.671	1.836	2.007	2.284	2.370	2.565	2.766
31	1.326	1.467	1.617	1.776	1.941	2.115	2.295	2.481	2.676
32	1.284	1.422	1.569	1.722	1.881	2.049	2.221	2.403	2.592
33	1.245	1.380	1.521	1.668	1.824	1.986	2.154	2.331	2.514
34	1.209	1.338	1.476	1.620	1.770	1.929	2.091	2.262	2.439
35	1.173	1.299	1.434	1.572	1.719	1.872	2.031	2.199	2.370
36	1.140	1.263	1.395	1.530	1.671	1.821	1.974	2.136	2.304
37	1.110	1.230	1.356	1.488	1.626	1.770	1.921	2.079	2.241
38	1.080	1.197	1.320	1.449	1.584	1.725	1.872	2.025	2.184
39	1.051	1.167	1.287	1.413	1.542	1.680	1.824	1.971	2.127
40	1.026	1.137	1.254	1.377	1.503	1.638	1.779	1.923	2.071
41	1.002	1.110	1.224	1.344	1.467	1.599	1.734	1.875	2.022
42	0.978	1.083	1.194	1.311	1.434	1.560	1.692	1.830	1.974
43	0.954	1.059	1.167	1.281	1.398	1.524	1.653	1.788	1.929
44	0.933	1.035	1.140	1.251	1.368	1.488	1.617	1.749	1.884
45	0.912	1.011	1.113	1.224	1.338	1.455	1.581	1.710	1.842
46	0.891	0.990	1.089	1.197	1.308	1.425	1.545	1.671	1.803
47	0.873	0.969	1.068	1.173	1.281	1.395	1.512	1.635	1.764
48	0.855	0.948	1.044	1.146	1.254	1.365	1.482	1.602	1.728
49	0.837	0.927	1.023	1.122	1.227	1.338	1.452	1.569	1.692
50	0.822	0.903	1.002	1.101	1.203	1.311	1.422	1.539	1.659

TABLE B.—*Strength of Red or Yellow Fir Beams—Breadth one inch*

Len. in feet.	DEPTH IN INCHES								
	28	29	30	31	32	33	34	35	36
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons*	*Tons.*
1	89.253	95.736	102.456	109.404	116.568	123.975	131.595	139.455	147.540
2	44.625	47.868	51.228	54.702	58.284	61.986	65.796	69.729	73.770
3	29.751	31.912	34.152	36.468	38.856	41.325	43.866	46.485	49.179
4	22.314	23.934	25.614	27.351	29.142	30.993	32.898	34.863	36.885
5	17.850	19.146	20.490	21.879	23.311	24.795	26.319	27.891	28.508
6	14.874	15.957	17.076	18.234	19.428	20.661	21.933	23.241	24.588
7	12.750	13.677	14.637	15.627	16.653	17.709	18.801	19.923	21.075
8	11.157	11.967	12.807	13.674	14.571	15.495	16.479	17.433	18.441
9	9.915	10.638	11.385	12.171	12.951	13.776	14.622	15.495	16.392
10	8.925	9.573	10.245	10.941	11.658	12.396	13.161	13.944	14.754
11	8.115	8.703	9.315	9.945	10.596	11.271	11.964	12.678	13.411
12	7.437	7.977	8.538	9.117	9.714	10.332	10.968	11.622	12.294
13	6.864	7.365	7.881	8.415	8.967	9.537	10.122	10.728	11.349
14	6.375	6.837	7.317	7.815	8.328	8.856	9.399	9.960	10.539
15	5.949	6.384	6.831	7.293	7.773	8.265	8.772	9.297	9.837
16	5.577	5.985	6.302	6.837	7.287	7.749	8.226	8.715	9.222
17	5.250	5.631	6.027	6.435	6.858	7.293	7.740	8.202	8.679
18	4.959	5.319	5.691	6.078	6.477	6.885	7.311	7.746	8.196
19	4.698	5.040	5.391	5.757	6.135	6.525	6.927	7.338	7.764
20	4.461	4.788	5.124	5.469	5.829	6.198	6.579	6.972	7.377
21	4.251	4.560	4.878	5.208	5.550	5.904	6.267	6.642	7.026
22	4.056	4.353	4.656	4.974	5.298	5.634	5.982	6.339	6.705
23	3.879	4.164	4.455	4.758	5.067	5.391	5.721	6.063	6.414
24	3.720	3.990	4.269	4.557	4.857	5.166	5.484	5.811	6.147
25	3.570	3.831	4.098	4.374	4.662	4.959	5.265	5.577	5.901
26	3.432	3.681	3.942	4.209	4.482	4.770	5.061	5.364	5.676
27	3.306	3.546	3.795	4.053	4.317	4.593	4.875	5.166	5.463
28	3.186	3.420	3.660	3.906	4.164	4.428	4.701	4.980	5.268
29	3.078	3.300	3.534	3.771	4.020	4.275	4.539	4.809	5.088
30	2.973	3.192	3.414	3.648	3.885	4.131	4.386	4.650	4.917
31	2.877	3.087	3.306	3.528	3.759	3.999	4.245	4.497	4.758
32	2.787	2.991	3.201	3.420	3.642	3.876	4.113	4.359	4.611
33	2.703	2.901	3.105	3.315	3.531	3.756	3.987	4.227	4.470
34	2.625	2.814	3.012	3.219	3.429	3.645	3.870	4.101	4.338
35	2.550	2.736	2.925	3.126	3.330	3.543	3.759	3.984	4.215
36	2.478	2.668	2.844	3.039	3.237	3.444	3.654	3.871	4.098
37	2.412	2.586	2.769	2.955	3.150	3.351	3.558	3.768	3.987
38	2.349	2.517	2.694	2.877	3.069	3.261	3.462	3.669	3.882
39	2.289	2.454	2.625	2.805	2.988	3.177	3.375	3.576	3.783
40	2.229	2.391	2.559	2.733	2.913	3.099	3.288	3.486	3.687
41	2.175	2.334	2.499	2.667	2.841	3.024	3.210	3.402	3.597
42	2.124	2.277	2.439	2.604	2.775	2.952	3.135	3.321	3.511
43	2.076	2.226	2.382	2.544	2.709	2.883	3.060	3.243	3.432
44	2.028	2.175	2.328	2.487	2.649	2.817	2.991	3.168	3.354
45	1.983	2.127	2.277	2.430	2.589	2.754	2.922	3.099	3.279
46	1.938	2.079	2.226	2.376	2.532	2.694	2.859	3.033	3.207
47	1.899	2.037	2.178	2.325	2.478	2.637	2.799	2.967	3.138
48	1.857	1.992	2.133	2.277	2.427	2.583	2.739	2.904	3.075
49	1.821	1.953	2.091	2.232	2.379	2.529	2.685	2.844	3.012
50	1.785	1.914	2.049	2.187	2.331	2.478	2.631	2.787	2.949

ADVANTAGES OF COMPRESSED PEAT.

BY ALEXANDER S. BYRNE.

No. II.

In a former paper on this subject I omitted to notice a useful application of peat, of considerable importance to persons resident in districts where peat and vegetable *mosses* abound. I allude to the manufacture of beds. For this purpose, mosses are equal in value to the finest feathers; being equally soft and pleasant, more durable, more cleanly, more elastic, and more healthful. They are also less costly: for a few shillings the comforts of a good bed can be obtained, superior in many respects to hair or feathers.

The idea occurred to me about twelve months ago, while exploring the interior of the bogs of Allen; and I immediately tested its beneficial effect, by directing the peasantry of Robertstown to manufacture several large beds and occupy them for a few months. The result has proved highly satisfactory; and, I have no doubt, will induce many of the wealthier classes to provide for the comforts of their poorer countrymen during the inclemency of winter.

The *top* surface of turf lands and bogs consists of strong, fine peat, called *turf moss*, composed of very thin vegetable fibre, delicate, soft and elastic, like whip-cord or strong thread. When properly dried in the open air, or in drying rooms, and well shaken up, to separate the threads, it will bear considerable pressure without *matting* or losing its elasticity; and there are many reasons for supposing that these properties are retained for a number of years. I have seen thousands of acres that had been exposed to severe trials for a long period of time, without undergoing decomposition. More pleasant and agreeable beds cannot be conceived. They possess all the advantages of horse hair and springs; and from the great softness and elasticity of the fibre, possess the accommodating properties of fine feathers. They are certainly more healthful, because more easily cleansed. Fetid air and unhealthy exhalations from the human body

adhere less tenaciously, and it requires less time to cleanse and sweeten them.

In Lapland, the reindeer moss is invariably used for infants to repose on, being softer than any other description of bedding; and in the Cape de Verd islands, a moss somewhat resembling Carrigan moss, (only more thready and fibrous) is generally employed, *by preference*, as a substitute for feathers.

I am not sufficiently acquainted with botany to point out the varieties that are best suited for this purpose; but I have found that almost every description of "top turf," or "bog moss," consisting of thin threads interwoven together, is suited to the purpose when perfectly dried; and I strongly recommend *residents in the back woods* to fill a tick, and make at least one trial with such as they have. I saw some top-surface moss in the woods of Canada, well suited for this purpose, and have no doubt the same description may be found throughout the United States. It would save emigrants both trouble and expense, were such mosses usefully employed, and add much to their comforts.

Some kinds of turf will not answer, owing to their extreme softness and want of elasticity; the heat and moisture of the body causes them to adhere and become matted; or if dried too much, they lose their cohesive properties, become brittle, and break into small pieces like straw. These varieties, however, are the exception, not the general rule. Those who wish to make success more sure will find it advantageous to soak the moss for a few days in a solution of pyroligneous acid, (proportions, 1 pint of acid to 1 gallon of water) or in alum water, (proportions, 1 lb. of alum to 1 gallon of water); or a solution of silicate of potash will answer. Corrosive sublimate in solution is still better, or a solution of sulphate of zinc; the former having an astringent quality for binding and preserving the fibre, and the additional property of *coagulating* the vegetable albumen, which materially improves the mosses, and preserves them from rot. It is this property in corrosive sublimate which renders it so valuable in the preservation of timber.

I would here remark in reference to mosses, that when calcined in air-tight retorts, or air-tight vessels of any other kind,

with a small aperture for the volatile products to escape, they yield a fine charcoal, which is highly valuable in the manufacture of pigments, tooth powder, and blacking; for which purposes calcined mosses are superior to any other article. They are equally good for such applications after they have been used for bedding.

For the instruction of persons unacquainted with manufactures, I remark, that calcination is effected in vessels heated red-hot, the atmosphere being excluded, and a small aperture left for the gaseous products to escape: when all the gases are driven off, the process is complete. This may be easily ascertained by applying a piece of lighted paper to the aperture: if it does not ignite, the volatile products have passed off.

One pound of moss or *top-turf* charcoal, 1 lb. of treacle, 2 oz. of oil, and 4 oz. of oil of vitriol, mixed with 3 pints of cider, vinegar, or old beer, makes a blacking equal to the finest lustre. The vitriol should be added after the other ingredients are mixed.

We now resume the consideration of the subjects enumerated in our former paper; and first—the manufacture of iron by means of peat coke.

Charcoal iron, made by means of heat obtained from wood charcoal, is the best known at present in the markets: such is its value and superiority, that large quantities are annually imported into England from India and Sweden, and sold at the enormous price of £36 per ton, while English coke iron is sold at one-fifth the price. In considering this part of our subject, we shall endeavor to prove that peat coke *is of greater value* than the best charcoal, and that in the manufacture of iron it stands unrivaled as a fuel. Being a pure vegetable charcoal, it possesses heating properties analogous to wood charcoal, is equally free from those deleterious ingredients which abound in coal; and when properly compressed as recommended by Mr. Charles Williams of Dublin, or Mr. White of London, or as stated in our last paper, two tons of peat coke occupy *the same space* as *one* of charcoal; consequently, where *intensity of heat* is an object, *twice as much heat* can be obtained from peat coke as from the *hardest and closest* charcoal.

Before we enter upon the consideration of this question, we will give the particulars of an analysis of an inferior quality of peat which we gathered from the interior of the bogs of Allen with a view of ascertaining its calorific power. It was made with considerable care, by Mr. Charles Cowper, of the Royal Adelaide Gallery, London, and we have tested the accuracy of his report in several analyses since.

The calorific power was tried by the litharge test, recommended by Berthier, and employed by Mr. Everitt. This consists in mixing a given weight of the fuel with a sufficient quantity of litharge, and heating it in a crucible: the heating power is in proportion to the quantity of lead reduced. Thus, according to Berthier—

10 grs. of pure carbon gives of lead	340 grs.
10 grs. of good wood charcoal, from	300 to 323 grs.
10 grs. of dry woods, from	120 to 140 grs.
10 grs. of good coke, from	260 to 285 grs.

According to Mr. Everitt's experiments—

10 grs. of peat coke, picked surface, gave	277 grs.
10 grs. of peat coke, *lower* strata	250 grs.
10 grs. of pressed peat	137 grs.

By Mr. Cowper's experiments, the following results were obtained, being averages of six or eight experiments each:

10 grs. of good Newcastle coal gave	284 grs.
10 grs. of oven coke	302 grs.
10 grs. of common peat	144 grs.
10 grs. of same coked in a crucible	259 grs.

For the information of those who are unacquainted with this subject, we would observe that the foregoing analysis is founded upon a well known fact—that the quantity of heat generated during the combustion of any fuel is in exact relation to the quantity of oxygen consumed in the process; it being ascertained that *oxygen* supports combustion. Hence, in order to ascertain the relative calorific powers of fuels, *it is only necessary to ascertain the quantity of oxygen each consumes in burning*.

By an average of two experiments made in a platinum crucible, the peat was found to yield $37\frac{1}{3}$ per cent of coke, and $3\frac{3}{8}$ of ash; and the coke, 9 per cent of ash. The coke is light and

friable, and the peat does not swell in coking like Newcastle coal. Thus, it will be seen that two tons of ordinary *uncompressed* peat are equal to one ton of Newcastle coal, and 7 tons of peat coke are equal to 6 tons of good coal coke. The coke gives about two-thirds as much heat as the peat from which it is obtained. It should however be remembered, in comparing peat coke with coke obtained from coal, that two tons of the former, when made from *compressed* peat, occupy the same space as one and a half of the latter; consequently the amount of heat present in the same furnace would be nearly one-third more, beside which peat coke is always free from sulphur and other deleterious matters so noxious to the smelter.

As wood charcoal is on many accounts superior to coke from coal in the manufacture of iron, we will not allude further to the latter, but confine our observations as much as possible to the former, in order to ascertain the true value of peat coke.

Prof. Everitt gives the following statement of his experiments in reference to this point, which, he observes, were made with great accuracy; and as the result of our own experiments correspond so nearly with his, we prefer giving his report as an authority. The density (or specific gravity) of

Water	1000
Compressed peat	1160
" " less pressed	910
Peat coke, hard pressed	1040
" " less pressed	913
Hardest and dry woods (such as oak, &c.)	800 to 835
Lighter woods (such as poplar, pine, &c.)	383 to 530
Charcoal from hard woods	400 to 625

Hence we see that the hardest compressed peat is denser than the hardest woods in the relation of 1160 to 835; and compared with some of the lighter woods, nearly double. Further, that the coke prepared from compressed peat is nearly double the density of ordinary charcoal. In common practice it is reckoned that 100 lbs. of charcoal occupy the same space as 200 lbs. of coke. Peat coke would occupy, weight for weight, the same space as common coke.

Professor Everitt further remarks: "From my trials, I am of opinion:—1. That the peat coke examined by me (common

Lancashire turf,) contains nothing which would, during the burning, be more injurious to iron than *wood charcoal* or the *best* coke, whether it be used to work iron, or under boilers for the generation of steam.—2. That it is equal to *the best coke*, weight for weight; and in heating power a little inferior, weight for weight, to wood charcoal, where quantity of each is the only consideration; but where bulk of stowage and *high intensity of heat** are important considerations, it is *superior* to wood charcoal."

The peat examined by Prof. Everitt was common Lancashire peat; but I have found numerous tracts which excel it in purity and calorific power, and contain a much smaller proportion of combustible matter. I have also frequently compressed peat, by means of a stamper press and the use of heat, to a density exceeding that examined by Everitt in the proportion of 1359 to 1160; the density, therefore, of peat coke may be proportionably increased, in relation to ordinary charcoal, as 1120 to 500.

It must be evident from the foregoing remarks, that peat coke is of greater value in the manufacture of iron than the best wood charcoal, *(unless, by softening wood, compression to the same density could be attained)* affording, as I have clearly shown, the important property of high intensity of heat in a small space, and the absence of all deleterious mixtures. Its advantages in this branch of trade should arouse public attention, and induce possessors of turf lands to bring this kind of coke into general use.

But in the manufacture of iron it is not necessary to coke or compress peat in order to use it beneficially, as on account of its purity and density it is equal to wood charcoal, and in some respects superior to coal. We have seen it used in forges and in blast furnaces with the greatest advantage. Henry Scale, Esq. one of the proprietors of the Aberdare Iron Works, Glamorganshire, informed us that successful experiments had been made in Wales. Mr. William Jones, furnace manager at Mr. Crawshay's works, Hirwain, in the same county, and Mr. Taylor of Hirwain, (both eye-witnesses) informed us, that in the year

* In smelting iron, this is the chief consideration —A. S. B.

1838, a trial of peat in its natural state was made at the Hirwain Iron Works, near Aberdare, to ascertain its value in smelting iron. The proportions were about four-fifths of common coke from coal and one-fifth of peat. Now mark the results: The quality of the iron produced was *cast* iron, "First Foundery," (called No. 1 Foundery.) The trial was continued for a few days with equal success; but as there is little peat in that district, it was not followed up, for fear of giving an advantage to manufacturers residing in peat counties.

The quality of the iron previous to the application of the peat was what is technically called "white iron," the most inferior description; but the result of the experiment was the production of "gray iron," of a highly carburetted character, technically called "foundery." The peat was of the black class, and used as it came from the bog, many portions being quite wet.

We heard in a letter from Mr. John Evans, of (Sir John Guest's) Dowlais Iron Works, that Mr. W. Daniell, of Abercarn, occasionally used peat in his chaferies, in lieu of charcoal. We addressed him a letter, and received the following answer:

Dear Sir:—In reply to yours of the 24th inst. I remark, the mode I used peat was mixed with charcoal, say two-thirds charcoal and one third dried peat. I made the *very best iron* for tin plate. The iron was made in a finery. I think it possible *to use peat alone*. I have not seen any of the Irish peat compressed, and therefore cannot give an opinion whether it can be used in blast furnaces to advantage or not.

I am, dear sir, your ob't serv't,

WILLIAM DANIELL.

Perhaps one reason why good peat is preferable to any other article in smelting iron ores, welding, softening steel plates, &c. is, that the excess of carburetted hydrogen known to exist in such substances, and the quality of the gaseous products generally, act more readily upon metallic bodies. It is certain that iron works more "kindly," as it is termed, and is sooner brought to a welding heat by the use of peat than with any other fuel.

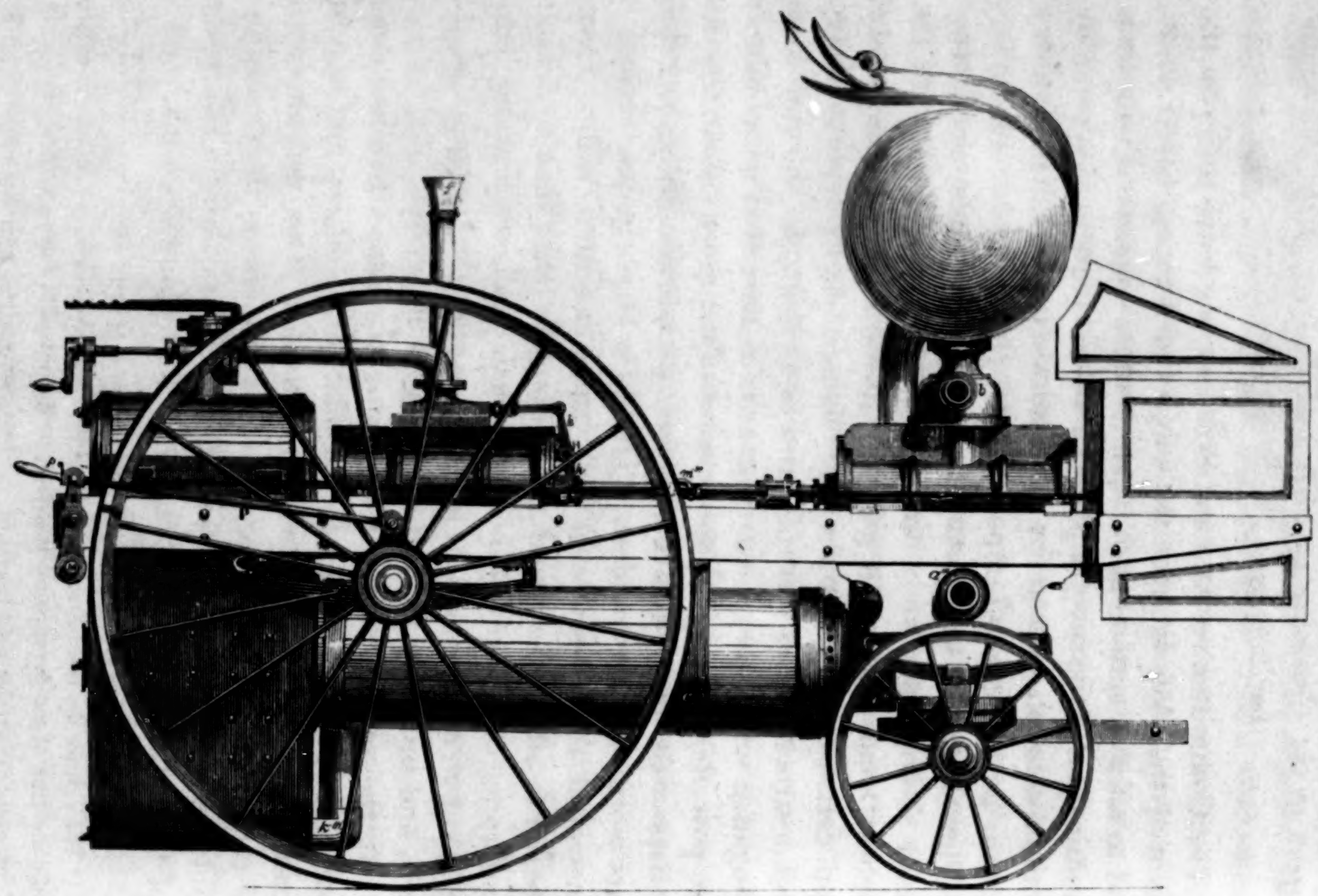

Fig. 2. ERICSSON'S STEAM FIRE ENGINE.

STEAM FIRE-ENGINE.

Report of the Committee on Arts and Sciences of the Mechanics' Institute, upon the Steam Fire-Engine.

The Committee on Arts and Sciences beg leave to report the result of their labors upon the subject of a Steam Fire-Engine, and to offer a statement of such matters connected with their examination of the several plans submitted to them, conformably to the resolution passed by the Institute on the 7th of January last, as have a general importance.*

The efforts of this institution to effect a public good were never more opportunely directed than when it held forth the highest honor within its gift as a reward for the most useful application of steam to the fire-engine. At that period large and destructive fires were of alarming frequency. Incendiarism —against which the ordinary guards of care and watchfulness are powerless—had laid waste some of the most valuable warehouses of the city, involving in their destruction millions of dollars worth of merchandise. The Fire Department, though it answered the oft-repeated calls upon it with a willing spirit, ceased to afford the usual protection, for the limit to human endurance of fatigue had been reached. Science and mechanical skill were appealed to for help to stay the progress of the evil, and promptly has the appeal been answered.

At the period named for opening the plans, five had been submitted, all possessing the requisite of *usefulness*, and accompanied by illustrative drawings or a model. One was afterward withdrawn by the inventor, who for some reason the Committee did not clearly comprehend, declined furnishing a statement of the capabilities of his engine. The plans were taken up in

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* We extract the resolution here referred to by the Committee, from the minutes of a meeting of the Mechanics' Institute, held on the 7th January, 1840:—

Resolved, That the gold medal of the Institute will be awarded for the best plan of a Steam Fire-Engine ; the plan to be illustrated by proper drawings or by a model. Such plans only, with their illustrations, will be admitted for competition, as shall be considered useful. The plans, &c. to be submitted to the "Committee of the Institute on Arts and Sciences," before the 4th day of July, 1840, and not to be opened by the Committee before that day, unless by the consent of the proposer.

Note by the Editor.

order, and deliberately canvassed, and written series of questions transmitted to the inventors, to elicit information upon such points as were not fully explained. To render their investigations still more thorough, your Committee when they deemed themselves acquainted with the details of each plan, invited the competitor to be present at a meeting, where he had an opportunity to make such statements as he thought necessary upon the operation of his engine. This last information was only available from such as resided in this city; but as these formed three of the four remaining competitors, it will be seen that very little was left in uncertainty.

Desirous that a subject of such importance should receive nothing short of the fullest examination they could give to it, your Committee, before the close of their labors, addressed letters to several gentlemen, whose experience, from their scientific pursuits or position in society it was desirable to consult, inviting them to be present at an examination of the plans submitted. A number of these met twice with the Committee, and frankly afforded to them a large amount of information.

Before making a comparison of the claims to excellence of the several plans before them, the Committee tested the capabilities of each by the most approved calculations and formulæ; and from the results of these the engines were judged.

Limits were fixed to the quantity of water necessary to be thrown per minute: the least amount being that which the machine should discharge to render it effective in the required degree; the greatest, that quantity beyond which it is not expedient to go, as the surplus would not compensate for the increased size and weight of the engine. The same reasons governed them in fixing limits to the height of jet.

The plans all being at least *equal* to the required duty, the remaining qualities were as follows:

Efficiency of boiler.
Facilities for raising steam after an alarm is given.
Simplicity of construction.
Rapidity with which the engine may be taken to the fire.
Lightness compatible with strength.
Facilities for re-raising steam.

Efficiency of boiler was a quality possessed by all the plans; and though existing in some in a superfluous degree, yet as the excess involved *complexity of construction* and *increased weight*, it brought its own correctives.

The points of excellence as thus narrowed down were found to belong in a superior degree to an engine weighing less than $2\frac{1}{4}$ tons, that with the lowest estimated speed has a power of 108 men, and will throw 3000 lbs. of water per minute to a height of 105 feet, through a nozzle of $1\frac{1}{2}$ inches diameter. By increasing the speed to the greatest limit easily and safely attainable, the quantity of water thrown may be much augmented.

This engine is the invention of Capt. J. Ericsson; and your Committee, exercising the power conferred upon them, have awarded to that gentleman the Gold Medal of the Institute, in conformity with the original resolution, to which they have before referred.

While thus announcing the performance of a duty, the Committee would add an expression of the strong desire they feel to recommend this engine to general notice. Its intrinsic merits no less than the reputation of the inventor, so long and favorably known to the mechanical world, demand for it the serious attention of public bodies, and all others interested in the preservation of property from fire.

Neatly executed drawings of the engine, accompanied by a full description, have been deposited by Capt. Ericsson in the Library of the Institute.

Respectfully submitted, by

J. B. WHITMAN, H. DURELL, C. W. COPELAND, W. B. NORTH, J. H. DURYEA, W. A. COX, *Ch'n*, J. J. MAPES, *Secr'y*,	*Committee on Arts and Sciences.*

CAPT. ERICSSON'S STEAM FIRE-ENGINE.

DESCRIPTION OF THE DRAWING.

Fig. 1—Represents a longitudinal section of the boiler, steam engine, pump, air vessel, and blowing apparatus, through the centre line.

Fig. 2—Side view of the steam fire-engine complete.

Fig. 3—Plan or top view of the engine : air vessel, slide box of steam cylinder and induction pipe supposed to be removed.

Fig. 4—Transverse section of the boiler, through the furnace and steam chamber.

Fig. 5—Lever or handle for working the blowing apparatus by manual labor.

Similar letters of reference will be used to denote similar parts in all the figures.

A. Double acting force pump, cast of gun metal, firmly secured to the carriage frame by four strong brackets cast on its sides.—*a*, *a*. Suction valves.—*a'*, *a'*. Suction passages leading to the cylinder.—*a''*. Chamber containing the suction valves, and to which chamber are connected *a'''*, *a'''*. Suction pipes to which the hose is attached by screws in the usual manner, and which may be closed by the ordinary screw cap. The delivering valves and passages at the top of the cylinder are similar to those just described, but the valve chamber communicates directly with

B. Air vessel of a globular form, made of copper.—*b*, *b*. Delivery pipes to which the pressure hose is attached: when only one jet is required, the opposite pipe may be closed by a screw cap, as usual. The piston or bucket of the force-pump to be provided with double leather packing; the piston rod to be made of copper; the gland and stuffing box to be made of brass.

C. Boiler, constructed on the principle of the ordinary "locomotive boiler," and containing 27 tubes of 1½ inch diameter. The top of the steam-chamber and the horizontal part of the boiler to be covered with wood, to prevent the radiation of heat.—*c*. Fire door.—*c'*. Ash pan, consisting of a square box attached below the furnace, and having a small door in front.—*c''*. Square box attached to the end of the boiler, inclosing the exit of the tubes. The hot air from the tubes received by this box is passed off through—*c'''*. Smoke pipe, carried up through either of the spaces **D**, making a half spiral turn round the air vessel, and terminating in the form of a serpent or a dragon, to avoid the unsightly appearance of an abrupt vertical termination.—c^4. Brackets of wrought iron, riveted to the upright part of the boiler, and bolted to the carriage

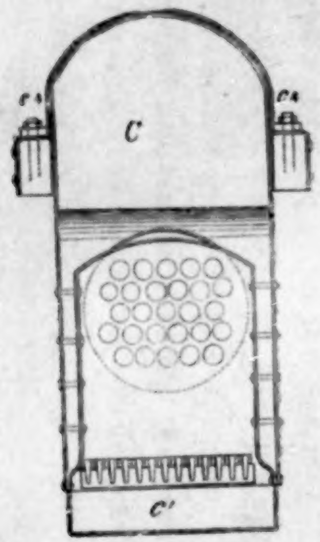

Fig. 4.

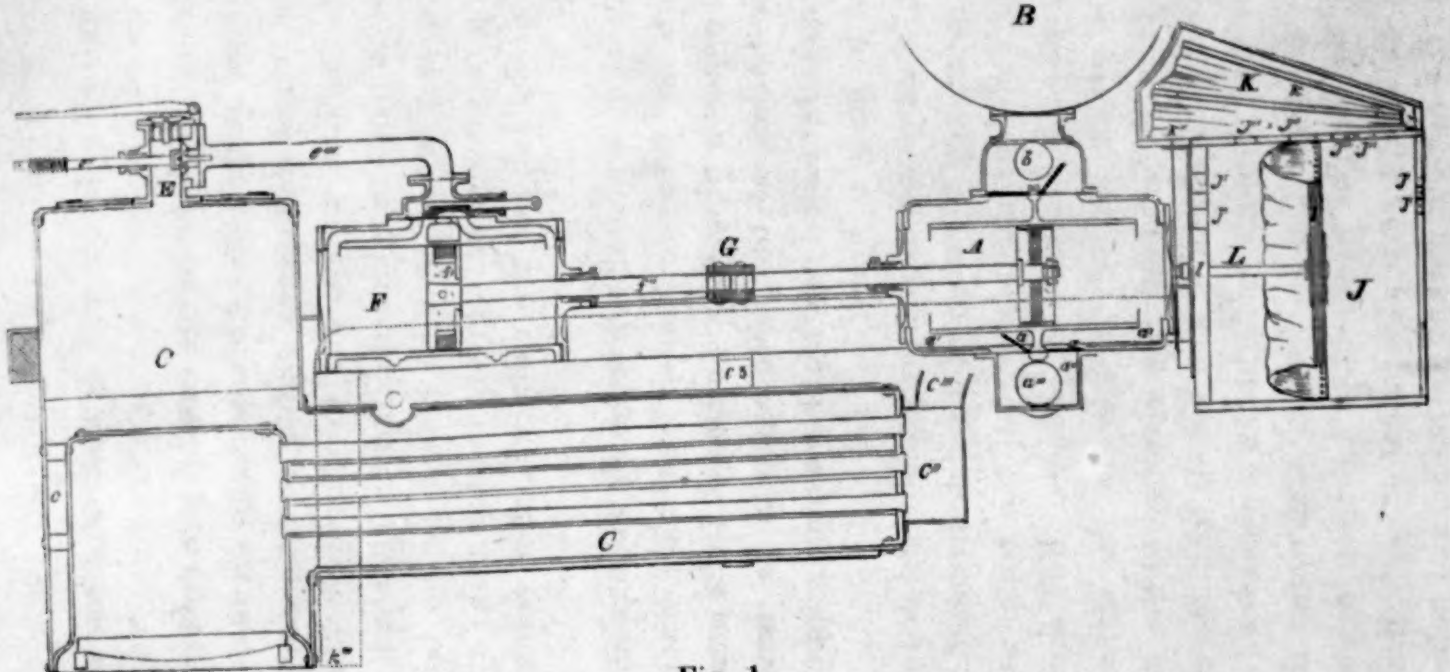

Fig. 1.

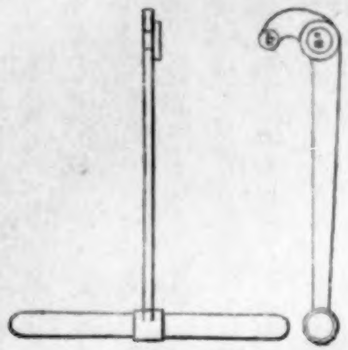

Fig. 5.

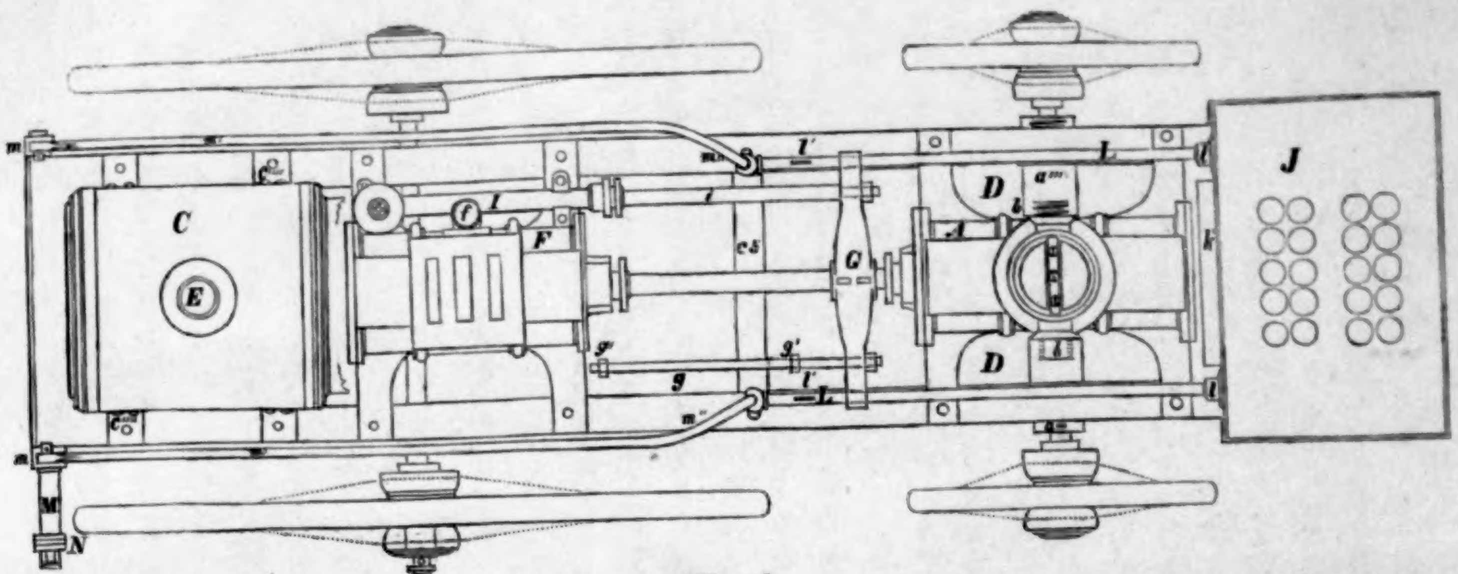

Fig. 3.

frame.—c^5. Wrought-iron stay, also bolted to the carriage frame, for supporting the horizontal part of the boiler.

E. Cylindrical box attached to the top of the steam chamber, containing :—*e*. Conical steam valve, and also—e'. Safety valve.—e''. Screw with handle connected to the steam valve, for admitting or shutting off the steam.—e'''. Induction pipe, for conveying the steam to

F. Steam cylinder, provided with steam passages and slide valve, of the usual construction, and secured to the carriage frame in similar manner to the force pump.—*f*. Eduction pipe, for carrying off the steam into the atmosphere.—f'. Piston, provided with metallic packing, (on Barton's plan).—f''. Piston rod of steel, attached to the piston rod of the force pump by means of

G. Crosshead of wrought iron, into which both piston rods are inserted and secured by keys.—*g*. Tappet rod attached to the crosshead, for moving the slide valve of the steam cylinder by means of—g',g'. Nuts which may be placed at any position on the tappet rod.

H. Spindle of wrought iron, working in two bearings attached to the cover of the steam cylinder, the one end thereof having fixed to it—*h*. Lever, moved or struck ultimately by the nuts g', g'.—h'. Lever, fixed to the middle part of the spindle H, for moving the steam valve rod.

I. Force pump for supplying the boiler, constructed with spindle valves on the ordinary plan ; the suction pipe thereof to communicate with the valve chamber of the water cylinder, and the delivering pipe to be connected to the horizontal part of the boiler.—*i*. Plunger of force pump, to be made of gun metal or copper, and attached to the crosshead G.

J. Blowing apparatus, consisting of a square wooden box, with panneled sides, in which is made to work—*j*. Square piston, made of wood, joined to the sides of said box by leather.—j'. Circular holes or openings through the sides, for admitting atmospheric air into the box ; these holes being covered on the inside by pieces of leather or India rubber cloth to act as valves.—j''. Are similar holes through the top of the box, for passing off the air at each stroke of the piston, into

K. Receiver or regulator, which has—*k*. Moveable top, made of wood, joined by leather to the upper part of the box ; a thin sheet of lead to be attached thereto, for keeping up a certain compression of air in the regulator.—k'. Box or passage made of sheet iron, attached to the blowing apparatus, and having an open communication with the regulator at k'', to this passage is connected a conducting pipe, as marked by dotted lines in Fig. 1, for conveying the air from the receiver into the

ash-pan, under the furnace of the boiler, at k'''; this conducting pipe passes along the inside of the carriage frame, on either side.

L. L. Two parallel iron rods, to which the piston of the blowing apparatus is attached: these rods work through guide brasses l, l, and they may be attached to the crosshead G, by keys at l', l'. The holes at the ends of the crosshead for admitting these rods, are sufficiently large to allow a free movement whenever it is desirable to work the blowing apparatus independently of the engine.

M. Spindle of wrought iron, placed transversely, and working in two bearings fixed under the carriage frame: to this spindle are fixed —m, m. Two crank levers, which by means of—m', m'. Two connecting rods, will give motion to the piston rods L, L, by inserting the hooks m'', m'', into the eyes at the ends of the said piston rods.

N. Crank lever, fixed at the end of spindle M, which by means of

O. Crank pin, fixed in the carriage wheel, and also

P. Connecting rod, will communicate motion to the blowing apparatus, whenever the carriage is in motion, and the above parts duly connected.

n. Pin fixed in lever N, placed at súch distance from the centre of spindle M, that it will fit the hole n' of the lever shown in Fig. 5, whilst n'' receives the end of spindle M. Whenever the blowing apparatus is to be worked by the engine or by manual force, the connecting rod P should be detached by means of the lock at p. The carriage frame should be made of oak, and plated with iron all over the outside and top; the top plate to have small recesses, to meet the brackets of the cylinders, as shown in the drawing. The lock of the carriage, axles and springs to be made as usual, only differing by having the large springs suspended *below* the axle. The carriage wheels to be constructed on the suspension principle; spokes and rim to be made of wrought iron, very light.

With regard to the power of the engine represented by the drawing, I estimate it equal to 108 men. The pressure in the boiler being kept at 65 lbs. per square inch, and the steam piston being 10 inches diameter, its effective force, considering the *direct* application, will be at least 4000 lbs. which multiplied by 135 feet, (or 45 double 18-inch strokes) will be 540,000 lbs. raised one foot per minute; this, divided by 5000, (the power of man) gives 108. The piston of the force pump being only 9 inches in diameter, whilst the steam piston is 10 inches in diameter, and the pressure of the steam kept at 65 lbs. to the square inch, I can state from experience that in calm weather the water will be projected 110 feet perpendicularly.

The size of the jet will be determined by the following calculation: *Effective* pressure on steam piston$=50$ lbs. per square inch; proportion of pistons as 81 to 100; hence, $\frac{50\times100}{81}=61$ lbs. per square inch pressure in the air vessel. The weight of one cubic foot of water being 62.5 lbs. it will be seen that 61 lbs. pressure is equal to 142 feet column of water; for $\frac{61\times1728}{62.5}=1713$, which divided by $12=142$. Under ordinary circumstances this will produce a pressure at the exit of the jet equal to 130 feet column; hence, it will issue at the rate of $\sqrt{130}\times5.3=60$ feet per second, or 3600 feet per minute. Deducting the loss of water by the valves, &c. the *effective* area of the piston of the force pump will be 50 square inches; this multiplied by 135 will be 6750; and thus the jet will be $1\frac{31}{36}$ square inch, or full $1\frac{1}{2}$ inch diameter, in order to throw the greatest quantity of water to the maximum height. For less heights the jet will increase in the inverse ratio of the square roots of the respective elevations.

The experience which I have had in the management of steam fire-engines induces me to suggest, before I conclude, that the best way of keeping the engine always in readiness, is that of having a small boiler or hot-water stove erected in the place where the engine is kept, and by means of a connecting pipe, with a screw joint, keep up heat in the engine boiler; the fire grate or flues of which should be kept very clean, with dry shavings, wood and coke carefully laid in the furnace, ready for ignition: a torch should always be at hand to ignite with at a moment's notice. The plan of keeping up a *constant* fire in the engine boiler is bad in practice, as it prevents the keeping the flues clean, and causes formation of sediment in the boiler, to say nothing of wear and tear; but which is still more important, perhaps at the very moment of the word of fire being given, the furnace is covered with clinkers, or the engineer is busy cleaning it.

The principal object of a steam fire-engine being that of not depending on the power or diligence of a large number of men, one or two horses should always be kept in an adjoining stable for its transportation. To this fire-engine establishment the word of fire should be given, without intermediate orders: the horses being put to, the rod attached connecting the carriage wheel to the bellows, and the fuel ignited, the engine may on all ordinary occasions be at its destination, and in full operation, within ten minutes.

J. ERICSSON.

New-York, July 1, 1840.

Daguerreotype Improvement.—In addition to the improvements we noticed in our last number, respecting the Daguerreotype, Mr. Goode of the University has succeeded, by using a solar microscope, in copying microscopic objects; nearly perfect impressions have been obtained of the wings of insects, and of the globules of the blood. In consequence of the inflection of the light, which always takes place in its passage near fibres and other minute bodies, colored fringes appear, which are injurious to the impression; that of one edge of a fine line being white, from the action of the blue light, while on the other it is black, from the action of the yellow light; at the same time a white line appears along the middle of the fibre, giving it the appearance of a tube, although it may be perfectly solid. Some experiments are in progress to remove this difficulty.

Erratum.—In the reported proceedings of the Lyceum of Natural history, vol. i, p. 420, of this journal, Mr. W. C. Redfield is inadvertently reported as stating that certain spots in the granite of the Exchange and other buildings "had all the appearance of fossils." Mr. R. merely mentions that some of the spots noticed have an outline which bears some resemblance to certain fossils in the Siberian rocks.

It is proper to remark that members are not held responsible for the reports of conversations. B.

NOTICES OF NEW PUBLICATIONS.

Architecture of the Heavens.—We have examined a work under this title, by Prof. Nichols, LL. D., F. R. S. E., of Glasgow, Scotland, and just republished from the late London edition by H. A. Chapin & Co. 138 Fulton-street, with many fine plates, a glossary, notes, &c.; and although as yet our examination has not been adequate to the merits of the work, or our wishes, yet we are prepared to say that it is one of remarkable interest. The learned author has treated the important subjects of the *nebulæ* and the double stars, with all their phenomena, which have been heretofore very little understood, in the most familiar and attractive manner. Rarely, indeed, have we met with a treatise on scientific subjects so intensely interesting throughout, both in style and the matter treated of, as this. It is believed, in fact, that few have conceived of the startling truths involved in the nebular theory, or imagined perhaps that the late discoveries in astronomical science, to which this work is principally devoted, lead to new and highly important conclusions respecting the origin and formation of worlds. In Europe it would seem to have lately attracted the attention to which it is entitled, from the fact that the work has run through three editions within a few months. In conclusion, we strongly commend it to the immediate and attentive perusal of the philosophic and curious.

PROGRESS OF THE MECHANIC ARTS.

On the Manufacture of Flint Glass. By Apsley Pellatt, *Assoc. Inst. C. E.*

Flint glass, called by the French "cristal," from its resemblance to real crystal, is composed of silex (whence the English name,) to which is added carbonate of potash and litharge, or red lead; to which latter material is owing, not only its great specific gravity, but its superior lustre, its ductility, and power of refraction.

It is necessary for optical purposes that flint glass should be perfectly free from striæ, otherwise the rays of light passing through it diverge and become distorted, and this defect is caused by the want of homogeneity in the melted mass, occasioned by the difficulty of perfectly fusing substances of such different density as the materials employed. The materials, being properly prepared, are thrown at intervals into a crucible of Stourbridge clay, which will hold about 1600 lbs. weight of glass when fused. The mouth of the crucible is then covered with a double stopper, but not luted, to permit the escape of the moisture remaining in the materials, as well as the carbonic acid gas and excess of oxygen. It requires from 50 to 60 hours application of a rapid, intense, and equal heat to effect the perfect fusion of the materials and to drive off the gas; during which time the unfused particles and excess of salts are skimmed off as they rise to the surface. The progress of fusion cannot be watched, nor can any mechanical means for blending the material during fusion be resorted to, lest the intensity of heat requisite for the production of a perfectly homogeneous glass should be diminished, the quality of the product being influenced by any inattention on the part of the fireman, as well as by the state of the atmosphere or of the wind. It has been ascertained that there is a certain point or crisis of fusion at which the melted metal must be kept to insure a glass fit for optical purposes, and even when that point be attained, and the crucible shall furnish proper glass during several hours, should there be such diminution of heat as to require the furnace to be closed, the remainder of the metal in the crucible becomes curdy and full of striæ, and thus unfit for use. It is the same with the glass made for the flat bore tubes for thermometers, which are never annealed, because the smoke of the annealing furnace would render the interior of the bore unfit for the reception of the mercury. These tubes will only bear the heat of the blow-pipe when they are made from a metal which has been produced under all the favorable circumstances before described. It is, therefore, to be inferred, that the most homogeneous and perfect flint glass can only be produced by exposure to an intense and equable degree of heat, and that any excess or diminution of that heat is injurious to its quality.

The English method of manufacturing the flint *plate* for optical purposes is thus described. About 7 lbs. weight of the metal is taken in a ladle of a conical shape from the pot at the proper point of fusion, and blown into a hollow cylinder, cut open, and flattened into a sheet of glass of about 14 inches by 20, and varying in thickness from $\frac{3}{8}$ths to $\frac{1}{4}$th

of an inch. This plate is afterwards annealed, and in this state goes into the hands of the optician, who cuts and grinds it into the requisite form. When a glass furnace is about to be put out, whole pots of metal are sometimes suffered to remain in it, and cool gradually. The crucibles being destroyed, pieces of glass may be cloven from the mass of metal, softened by heat, and made to assume the requisite form, and then ground. It is believed that the excellent glasses made by Frauenhoffer, and other manufacturers on the continent, are produced by some such means. On attempting to cut glass ware, it is easily perceived if it be sufficiently annealed; if not, the ware is put into tepid water which is heated, and kept at the boiling point during several hours; it is then suffered to become gradually cold. This method is more efficacious than re-annealing by the ordinary means. A piece of unannealed barometer tube of 40 inches in length being heated and quickly cooled, contracted only $\frac{1}{16}$th of an inch, whereas a similar piece, annealed by the usual means, contracted nearly $\frac{1}{8}$th of an inch. Unannealed flint glass, being heated and suddenly cooled in water, exhibits the appearance of a mass of crystals; it is thence inferred that the process of annealing renders the glass more compact and solid; it thus becomes incapable of polarization.

Flint glass being remarkably elastic, has caused it to be used for chronometers. To prove its elasticity, a hollow ball of unannealed glass of 3 inches in diameter, weighing about 16 ounces was dropped, *when cold*, from a height of 7 feet upon a stone floor; it rebounded uninjured about 3½feet, but broke on falling to the ground after the rebound. Similar balls both at a *bright* and a *low red heat*, were dropped from the same height, and broke immediately without any rebound; thus demonstrating that its elasticity only exists while cold. Glass being sometimes deteriorated in the process of reheating, not only in color, but in its faculty of welding, by the sulphur existing in the coal or coke used in the furnace, this is prevented by occasionally throwing about a quart of cold water on the fire; the explosive vapor thus raised carries off the sulphureous gas.

The process of annealing has the remarkable property of carrying off from the glass the reddish tint imparted to it by manganese; and in large masses, not only the reddish tint disappears, but the glass sometimes becomes green or blue, probably by the action of the sulphureous acid gas from the coke. The reddish tint will however return, and the greenish one disappear, should the annealed glass be afterwards heated or remelted. Should the pot crack during fusion, and the flame or smoke come in contact with the melted metal, a green tint and abundance of dense striæ will be the consequence. Such an accident can only be repaired, if the crack be accessible, by throwing cold water on the exuding metal, which thus becomes gradually cooled, and itself forms a lute, so as to enable the process of melting to be continued. Long experience has shown that the best fuel for melting glass in the furnaces is oven-burnt coke mixed with a small quantity of screened coal.

Mr. Pellatt illustrated the preceding paper by specimens of glass exhibiting peculiar effects of crystalization; among them were cylindrical solid pieces of flint glass, which, from being suddenly cooled by plunging them into water, had the interior entirely dislocated, and were

merely held together by the exterior coating; portions of tubes showing the same effect; a portion of a vase of white glass dipped into blue glass of a greater density—in cooling, the interior white glass appeared to be crushed by the contraction of the exterior coating; a similar vase of white and blue glass of more equal density had cooled, and bore cutting without cracking; a mass of optical glass, exhibiting striæ, specks, and imperfections; which, together with the modes of manufacture, he explained.

In answer to several questions, Mr. Pellatt was not aware of any attempt having been made to cut the bulb of Prince Rupert's drops: he believed the peculiar property of the bursting of these drops or tears, on the end being broken, arose from a crack suddenly commencing and extending itself rapidly throughout the mass, causing the dislocation of the particles. Flint glass is seldom sufficiently fluid to make these drops; they are generally made from glass which does not contain lead.

Alluding to the use of plate glass in Nasmyth's Pneumatic Mirror, he observed that, owing to the absence of lead, plate glass was purer and more homogeneous than flint glass, and the equality of thickness produced by grinding and polishing enabled the curve caused by the pressure of the atmosphere to be very regular. Trans Inst. Civ. Eng.

Improvements in the manufacture of Flint and Crown Glass. From the Journal of Pharmacy for March, 1840.

On the 27th January last, M. Bontems director of the glass works at Choisy-le-Roi, read to the Academy of Sciences a paper describing a process by which he has been able to manufacture flint glass and crown-glass free from striæ and specks, and possessing perfect whiteness.

M. Guinand had succeeded before him in obtaining flint glass without striæ, by mixing the melted glass in a manner to make a mass exactly homogeneous. He was able to accomplish that result, by making cylinders of crucible earth. These cylinders were closed at the lower end and opened at the top, and so constructed as to receive hooked iron rods, by which the mass of melted glass could be kept in motion as long as it was necessary—the rods being renewed in the cylinder as often as they became heated. M. Guinand had thus resolved a part of the problem of manufacturing glass for optical purposes, but he had left in uncertainty some important elements of that problem.

Guided by the experience of that able manufacturer, M. Bontems has discovered that in the fabrication of flint and crown glass the absence of specks depends upon the proportions of the elements of the glass, and the management of the fire towards the end of the operation: thus whilst it has been heretofore found impossible to give to flint glass a density of 3.2 without injury to its whiteness, he has been able to produce flint glass of the density of 3.6 as white as the most beautiful crystal; and of crown glass as white as the finest plate glass of St. Gobain, or St. Quirin. He is now ready to furnish to opticians, discs of flint or crown glass, of 40, 50, and even 60 centimeters diameter. He has added to the memoir read, the plans of his furnace and crucibles, and described all the details of his process.

A mode of bending Discs of Silvered Plate Glass into concave or convex Mirrors, by means of the Pressure of the Atmosphere. By James Nasmyth.

The difficulty of obtaining large specula for telescopes, together with the disadvantages attending the weight, the brittleness and liability to oxidation, of the speculum metal generally used, induced Mr. Nasmyth to turn his attention to the employment of silvered plate glass for telescopic purposes, as it possesses perfect truth of surface, is lighter than metal, is not liable to oxidation, and a greater quantity of light is reflected from it than from any metallic surface.

To give a concave or convex form to a disc of plate glass, a certain pressure must be made to act equally over the surface. This equal pressure is obtained on Mr. Nasmyth's plan, by taking advantage of the weight of the atmosphere.

A disc of silvered plate glass, 39 inches in diameter and $\frac{3}{16}$ths of an inch in thickness, is fitted and cemented into a shallow cast-iron dish, turned true on its face, so as to render the chamber behind the glass perfectly air tight; by means of a tube communicating with this chamber, any portion of air can be withdrawn or injected.

To produce a concave mirror, so slight a power is required, that on applying the mouth to the tube and exhausting the chamber, the weight of the atmosphere, which amounts in this case to 3558 lbs.; acting with equal pressure over a surface of 1186 square inches, causes the glass to assume a concavity of nearly three-quarters of an inch, which, in a diameter of 39 inches, is far beyond what would ever be required for telescopic purposes. On re-admitting the air, the glass immediately recovers its plane surface, and on forcing in air with the power of the lungs, it assumes a degree of convexity nearly equal to its former concavity. The degree of concavity or convexity may be regulated to the greatest nicety, and it is proposed to render the degree of concavity constant, by placing in the air-tight chamber a disc of iron, turned to the required form, and allowing the pressure of the atmosphere to retain the glass in the form given to it by its close contact with the iron disc.

The curve naturally taken by the glass when under the pressure of the atmosphere, is believed by Mr. Nasmyth to be the catenary, inasmuch as its section would be the same as that of a line supended from each end, and loaded equally throughout its length.

Mr. Lowe did not feel well assured that the curve naturally taken by the "Pneumatic Mirror," was the catenarian, as the plate being set in a frame, was supported all round its periphery, and resembled an arch resting on its abutments. He suggested the propriety of attempting to attain given curves by grinding the plate of different thicknesses in parts, so that the pressure of the atmosphere should affect it unequally.

Mr. Macneill was inclined to believe the curve assumed was the "Elastic Curve,"—the properties of which were examined by James Bernouilli, in the Memoirs of the Academy of Science, 1703.

PROGRESS OF ENGINEERING.

The new Suspension Bridge of James Dredge. Abridged from the Lond. Mech. Magazine.

On Saturday, the 13th of June last, 1840, Mr. Dredge performed a series of experiments before the Professors of the College of Civil Engineers, at Gordon House, Kentish Town; several noblemen and gentlemen, not professionally connected with the College, were present as spectators, and they, as well as the students, appeared to take a deep interest in these experiments, the results of which illustrated, in a very satisfactory manner, both of those principles in which the essence of this improvement consists. These are, *first*, the diminution of the suspension chains, from the abutments to the centre of the pendent curve; and *secondly*, the oblique position of the rods by which the roadway is supported.

The calculations submitted by Mr. Dredge, showed that the tapered chain, has at least twice the strength of an uniform one; but his experiments proved it to have more, for an uniform chain gave way when only nine persons were standing still on it, while eighteen persons standing on the tapered chain, had to jump before they could produce a fracture, the momentum of which must have been equivalent to a very considerable addition of weight.

That even the tapered chain is imperfect, if the roadway is supported by vertical rods, was clearly shown by Mr. Dredge in a model constructed for that purpose. This model consisted of the chains, with a spring-beam or steel-yard at the centre, a flexible piece of timber for the roadway, and cords for the suspension rods, which could be arranged either vertically, as in chain bridges of the old construction—or diverging from the centre as in Mr. Dredge's improvement. When the cords were arranged vertically, and the roadway pressed down, the strain was thrown towards the centre of the chain, as was shown by the action of the spring, which, when Mr. Dredge pressed down the roadway with both his hands, indicated a weight of 30 or 40 lbs. straining on the centre. When the suspension cords were arranged obliquely, or converging towards the centre at their lower extremities, the whole chain was called into action; and although the roadway was pressed down with equal or even greater force than before, the spring steel-yard remained quiescent, showing that there was not a single pound of unequal tension on the central part of the chains. This bringing up the whole chain into action, to whatever part of the roadway the weight is applied, is a most important feature of Mr. Dredge's improvements, and one which it seems the professedly learned in these matters are either unable or unwilling to understand; but this is no reason why the benefits of it should not be understood, appreciated, and turned to practical account by the public, and especially by all who have an interest in the erection of structures of this kind. To the public, and the parties immediately concerned, it is a matter of small moment whether the inventor of that which is really useful is, or is not, a professional engineer, or a man whose name is enrolled in the list of science,

and is entitled to his dividend in the joint stock institution of mutual and reciprocal praise, local or national.

Lord Western, in a letter to Lord Melbourne upon the subject of Dredge's Suspension Bridge, says:

As I have observed before, upon Mr. Dredge's principle, the *strain* and *weight* only *commence* at the centre, *increasing* as the *strength* of the bridge *increases* up to the base, and of course its ability to sustain it; this difference between these two systems may be readily imagined, by supposing a ton of iron formed into a bar of equal dimensions from one end to the other, and fixed into a wall; it will hardly support itself, still less any additional load; if extended to any considerable length it will *not* support itself; on the other hand make the same weight of iron into a taper form, and it will support its own weight to any extent, and a heavy *extrinsic* weight in addition. But further than this, if the parallel equal sized bar is cut away by one half, it will then support itself and an *extrinsic* weight in addition. The reason is obvious—it has discharged itself of that which was altogether superfluous and therefore noxious in the extreme, being wholly *destructive* of power to carry any *extrinsic* weight.

Having thus endeavored to show the simple principle on which Mr. Dredge's system is founded, I proceed to give you some account of some experiments he has made, practically substantiating the truth of it, prefacing them however with a brief description of the expense and particulars of the Victoria bridge across the Avon, built in 1836, and which has proved itself equal to its inventor's most sanguine expectations. Its cost was 1650*l*, its span is 150 feet, and only 21 tons of iron were consumed in its construction, which at 20*l* per ton is only 420*l*: the great expense therefore was on the masonry and the timbers supporting the platform or road, which are still of insufficient dimensions and strength, but which of course are quite unconnected with the principle on which the bridge is built; the chains are under 10 tons, and are equal to sustain 500 tons on transit. In November he began putting the chains of this bridge together, and in the following month it was open for general use; its road is stoned like common roads. In further proof of the correctness of this system, tests have been made before various parties at various times, viz. at Bath, Jan. 2, 1838, before Messrs. Worsams from London, Ball; Cambridge, and others of Bath; with models whose *lengths*, *deflections* and *weight were equal;* the chains of each model between the fulcrums were only 9 oz. of wire, their spans were 4 feet 6 inches, their deflections 6 inches, and their platforms were 2 feet. The parallel chain model (old system) broke down on putting 6 sacks of beans on its platform, weighing about 13 cwt.; the taper chain model (new system) bore the 6 sacks of beans, 7 sacks of malt weighing 10 cwt., 2 cwt. of iron, and 11 men at the same time, all of which did not break it down.

We take from a paper read before the mechanical section of the British Scientific Association at Newcastle, Mr. Dredge's reasoning *a priori* upon the advantages of the Mathematical Suspension Bridge.

In every bridge there are two forces or actions—vertical and horizontal.

1st. In the plan I propose, the vertical force, or gravity, is borne by the arch, commencing at the centre of the bridge, and progressively increasing to the abutments.

2nd. The horizontal force is sustained by the roadway, which is rendered a rigid line.

3rd. The roadway is attached to the chains by a series of rods diagonally suspended, so that the entire weight of the structure concentrates by its nearest direction on the bases or towers respectively.

4th. The chains diminish from each base progressively, and gravity diminishes in the same ratio and in the same direction, by which the centre of the bridge is relieved of all vertical pressure.

5th. The chains being but lightly affected at their extremities, the moorings required are but trivial.

On the other hand, by the ordinary method of construction:—

1st. The vertical and horizontal forces are borne by the arch, and its centre is a *fulcrum* instead of the commencement of gravity.

2nd. The roadway being destitute of horizontal force, it is subject to great undulation and lateral motion.

3rd. The roadway being attached to the chains by rods suspended vertically, therefore half the weight of structure concentrates on its centre, and is oppressive inversely, according to its versed sine.

4th. The chains are mostly parallel throughout, and half of the whole weight of the structure is direct vertical pressure on the centre of the bridge.

5th. The chains are loaded at their extremities with all their horizontal force; the moorings required must be strong accordingly.

The advantages of a suspension bridge, or pier, on the mathematical principle, are, in fact, stability and economy, combined with lightness, strength, and simplicity of construction; these advantages are derived by passing the weight through a compound series of inclined planes to each respective base; there the horizontal force is transferred from the chains to the roadway by which the roadway is changed from neutrality to power; and by the subtraction of this force from the chains, more power, together with a considerable reduction of material, is obtained.

Description of the 'Nonsuch' iron passage boat. By Charles Wye Williams, C. E. *From Trans. Inst. Civil Engineers.*

The attention of Mr. Williams having been attracted to the successful plan for the conveyance of passengers adopted on the Glasgow and Paisley Canal, where light sheet-iron boats, of great length travel at a speed of nine miles an hour, he was induced to attempt the introduction of the same system on the Irish canals. A great difficulty, however, presented itself, as the locks there would only admit boats 60 feet long, which length was quite inadequate to the carrying out, with advantage, the principle involved in the long light Scotch boat. To overcome this difficulty, he constructed a sheet-iron boat, 80 feet long and 6 feet 6 inches wide at midships, having the stem and stern ends (each

10 feet long) attached by strong hinges to the body, and susceptible of being rapidly raised to a vertical position by means of winches; thus reducing the length to 60 feet when required to pass through a lock. It is evident that by this means there would be gained not merely the apparent additional buoyancy of 10 feet at each end of the boat, which from the form would not be very effective, but in reality the buoyancy due to an addition of 20 feet of the midship section. The boat thus constructed has been found to answer perfectly; the buoyancy is equal to that of the Scotch boats of similar dimensions; no crankness or unsteadiness accrues when the ends are raised; it is capable of carrying 60 passengers, travelling at a speed of 9 miles per hour, with the same power that was required to draw a 60 feet boat with a less load; and there is a much less action on the canal bank in consequence of the increased length, which at the same time imparts stiffness, and enables passengers to enter and leave the boat with safety. Considerable time is saved in passing the locks, by the opposition of the square end when the bow is raised; the boat may thus be run almost at full speed into the lock, and both ends being raised simultaneously, it is stopped much more easily than if the tapered ends were down. No provision is necessary for keeping the ends down, as the weight of the bow and steersman answers the purpose. This boat has been working without intermission, for three years, between Limerick and Killaloe, traversing twice daily a distance of 15 miles, on a navigation of considerable intricacy, and passing 11 locks, without any accident having hitherto occurred.

Mr. Parkes observed that, independent of the advantages of carrying more passengers, by continuing the midship section to the length of 60 feet, considerable speed was gained by the 80 feet boat, in consequence of its fine entrance and run. Mr. Williams informed him that the velocity was found to depend on the position of the boat on the wave; that the rider of the horses employed in towing the boat knew exactly the proper position of the wave with respect to the boat, and regulated the exertion of the horses accordingly—the velocity of the boat and the tractive force depending on the relative position of the boat and wave.

Mr Field, in reply to some remarks respecting the effect of these rising ends on the buoyancy of the boat, stated that he did not understand it to be Mr. Williams' design to obtain additional buoyancy thereby. The ends only press on the water as much as is due to their own weight, and are principally useful in giving a fine entrance and run to the boat; thus having the whole space between the rising ends for the accommodation of passengers, and obtaining an absolute gain of the whole space that is lifted at each end, as in a boat of the ordinary length there must be the same tapering of the bow and stern ends. So great is the facility in managing the ends, that on quitting a lock the bow end is lowered as the gates are opening; the boat is set in motion at the same time, and as it moves on the stern end is let down, and the usual speed obtained very soon after it clears the lock. When a lock is to be entered, the boat is suffered nearly to reach the gate at full speed, when the bow end being raised, the additional resistance caused by

the square section being suddenly opposed to the water, stops the boat almost immediately. The weight of one man, at each end, is amply sufficient to keep down the ends when the boat is in motion.

PROGRESS OF SCIENCE.

DR. J. W. DRAPER, *on the Daguerreotype and its application to taking portraits from the life. From the Lon. and Edin. Phil. Magazine.*

Very soon after M. Daguerre's remarkable process for Photogenic Drawing was known in America, I made attempts to accomplish its application to the execution of portraits from the life. M. Arago had already stated, in his address to the Chamber of Deputies, that M. Daguerre expected, by a slight advance, to meet with success, but as yet no account has reached us of that object being attained.

More than one hundred instances are recorded in Berzelius's chemistry, in which the agency of light brings about changes in bodies; these are of all kinds: formations of new compounds, re-arrangements of elements already in union, changes of crystallographic character, decompositions, and mechanical modifications.

The process of the Daguerreotype is to expose a surface of pure silver to the action of the vapor of iodine, so as to give rise to a peculiar iodide of silver, which under certain circumstances is exceedingly sensitive to light. The different operations of polishing, washing with nitric acid, exposure to heat, &c. are only to offer a pure silver surface; the operation of hyposulphite of soda, and the process, which I shall presently describe, of galvanization,* are to free the plate from its sensitive coating, and in no wise affect the depth of the shadows, as some of the French chemists at first supposed.

There is but one part of the Daguerreotype which does not yield to theory: on one point alone there is obscurity. Why does the vapor of mercury condense in a white form on those portions of the film of iodide, which have been exposed to the influence of light?—condense to an amount which is rigidly proportional to the quantity of incident light?

Even on this point there are facts which appear to have a bearing.

(*a.*) It has long been known, that if a piece of soapstone or agalmatolite be made use of as a pencil to write with on glass, though the letters that may have been formed are invisible, and though the surface of the glass may subsequently have been well cleared, yet they will come into view as soon as the glass is breathed on.

(*b.*) I have often noticed, that if a piece of very clear and cool glass, or what is better, a cold polished metallic reflector, has a little object, such as a piece of metal, laid upon it, and the surface be breathed over once, the object being then carefully removed, as often as you breathe again on the surface, a spectral image of it may be seen, and this sin-

* This process, the details of which were given in an article by Dr. Draper, published in Vol. I, No. 6, (for July) of the Am. Repertory, is for that reason left out of the present paper.—*Ed. Am. Rep.*

gular phenomenon may be exhibted for many days after the first trial was made.

(*c*.) Again, in the common experiment of engraving on glass by hydrofluoric acid, if the vapor has been very weak, no traces will be perceived on the glass after the wax has been removed; but on breathing over it, the moisture condenses in such a way, as to bring all the objects into view.

(*d*.) In a former number of this Journal I described a phenomenon which relates to the crystalization of camphor on surfaces of dry glass, on which moveable traces have been made by the pressure of a glass rod; this also appears to belong to the same class of effects.

Berzelius (Traité, vol. ii, p. 186.) has attempted to explain (*a*.) and (*c*.) on this principle, that the changed and unchanged surfaces radiate heat unequally. There may be strong doubts with some as to the correctness of this, but is not the Daguerreotype due to the same cause, whatever it may be?

We must separate carefully the chemical changes which iodide of silver undergoes in the sunbeam, from the mechanical changes which happen to the sensitive film: iodide of silver turns black in the solar ray, the whole success of the Daguerreotype artist depends on his checking the process before that change shall have supervened.

The coating of iodine is not *immediately* necessary to the production of images by the mercurial vapor. The cóndition seems to be traceable to the metallic surface. If you take a Daguerreotype, clean off the mercury, polish the plate thoroughly with rottenstone, wash it with nitric acid and bring it to a brilliant surface, yet if it has not been exposed to heat, the original picture will re-appear on exposure to the mercurial vapor. Is not this a result of the same kind as those just referred to?

As a polishing material for the Daguerreotype plate, common rottenstone and oil answer very well. The plate having been planished by the workman, is to be rubbed down to a good surface, and as high a polish given to it as possible; it is to be heated and washed with nitric acid, as indicated in the French account, and finished by being rubbed with whiting (*creta præparata,*) in the state of a very dry powder, going over it for the last time with a piece of clean dry cotton; this gives an intensely black lustre, which cannot be obtained by rottenstone alone, and thoroughly removes any film which nitric acid may have left.

To coat with iodine, I make use of a box about two inches deep, in the bottom of which that substance in coarse flakes is deposited; no cloth intervenes, but the silvered plate, with a temporary handle attached to it, is brought within half an inch of the crystals, and it becomes perfectly coated in the course of from one to three minutes; no metallic strips are necessary to insure this effect; if the edges and corners are thoroughly clean, the golden hue will appear uniformly.

M. Daguerre recommends, that the plate, after being iodized, shall be placed in the camera without loss of time. The longest interval, he says, ought not to exceed an hour. "Beyond this space the action of the iodine and silver no longer possesses the requisite photogenic properties."

There may be something peculiar in the preparation of the plate as

I have described it, but it is certain that this observation must be received with some limitation. A plate which has been iodized does not appear so quickly to lose its sensitiveness. On the other hand, by keeping it in the dark for twelve or twenty-four hours, its sensitiveness is *often remarkably increased.* Other advantages also accrue. Those who have made many of these photogenic experiments will have had frequent occasion to remark, that the film of iodine is not equally sensitive all over, that there are spots or cloudy places which do not evolve any impression, and often the whole is in that condition, that the bright parts alone come out, while the parts that are in shadow do not evolve correspondingly, nor can they be well developed, except at the risk of of solarizing the picture. Now, a plate that has been kept for several hours, is by no means so liable to these effects: I do not pretend to give any reason for this, but merely mention it as a fact, of considerable importance to the travelling daguerreotyper; he will find that the iodine does not lose its sensitiveness in many days.

In the subsequent process of mercurializing, it is of little importance what is the angular position. Several experimenters were for a time under the idea that an angle of 45° or 48° was a necessary inclination, in order that the plate should take the vapor; this arose from a misinterpretation of the printed account. Plates mercurialize equally well in a horizontal as in any other position; perhaps a slight inclination may be of advantage, in allowing the vapor to flow with uniformity over the iodized surface, but the chief use of an angle of 45°, is to allow the operator to inspect the process through the glass.

Sometimes it is advantageous to heat the mercury a second time, when the proof is not distinctly evolved at first. Indeed, it occasionally happens, that a proof which did not evolve at all at first, will come out quite fairly on raising the temperature of the mercury again.

In the first experiments which I made for obtaining portraits from the life, the face of the sitter was dusted with a white powder, under an idea that otherwise no impression could be obtained. A very few trials showed the error of this; for even when the sun was only dimly shining, there was no difficulty in delineating the features.

When the sun, the sitter, and the camera are situated in the same vertical plane, if a double convex non-achromatic lens of four inches diameter and fourteen inches focus be employed, perfect miniatures can be procured, *in the open air*, in a period varying with the character of the light, from 20 to 90 seconds. The dress also is admirably given, even if it should be black; the slight differences of illumination are sufficient to characterize it, as well as to show each button, button-hole, and every fold.

Partly owing to the intensity of such light, which cannot be endured without a distortion of the features, but chiefly owing to the circumstance that the rays descend at too great an angle, such pictures have the disadvantage of not exhibiting the eyes with distinctness, the shadow from the eyebrows and forehead encroaching on them.

To procure fine proofs, the best position is to have the line joining the head of the sitter, and the camera so arranged as to make an angle

with the incident rays of less than ten degrees, so that all the space between the eyebrows shall be illuminated, and a slight shadow cast from the nose. This involves obviously the use of reflecting mirrors to direct the ray. A single mirror would answer, and would economize time, but in practice it is often convenient to employ two; one placed, with a suitable mechanism, to direct the rays in vertical lines; and the second above it, to direct them in an invariable course towards the sitter.

On a bright day, and with a sensive plate, portraits can be obtained in the course of five or seven minutes, in the diffused daylight. The advantages, however, which might be supposed to accrue from the features being more composed, and of a more natural aspect, are more than counterbalanced by the difficulty of retaining them so long in one constant mode of expression.

But in the reflected sunshine, the eye cannot support the effulgence of the rays. It is therefore absolutely necessary to pass them through some blue medium, which shall abstract from them their heat, and take away their offensive brilliancy. I have used for this purpose blue glass, and also ammoniaco-sulphate of copper, contained in a large trough of plate glass, the interstice being about an inch thick, and the fluid diluted to such a point, as to permit the eye to bear the light, and yet to intercept no more than was necessary. It is not requisite, when colored glass is employed, to make use of a large surface; for if the camera operation be carried on until the proof *almost* solarizes, no traces can be seen in the portrait of its edges and boundaries; but if the process is stopped at an earlier interval, there will commonly be found a stain, corresponding to the figure of the glass.

The camera I have used, though much better ones might be constructed, has for its objective two double convex lenses, the united focus of which for parallel rays is only eight inches; they are four inches in diameter in the clear, and are mounted in a barrel, in front of which the aperture is narrowed down to 3½inches, after the manner of Daguerre's.

The chair in which the sitter is placed has a staff at its back, terminating in an iron ring, that supports the head, so arranged as to have motion in directions to suit any stature and any attitude. By simply resting the back or side of the head against this ring, it may be kept sufficiently still to allow the minutest marks on the face to be copied. The hands should never rest upon the chest, for the motion of respiration disturbs them so much, as to bring them out of a thick and clumsy appearance, destroying also the representation of the veins on the back, which, if they are held motionless, are copied with suprising beauty.

It has already been stated, that certain pictorial advantages attend an arrangement in which the light is thrown upon the face at a small angle. This also allows us to get rid entirely of the shadow from the back-ground, or to compose it more gracefully in the picture; for this, it is well that the chair should be brought forward from the back-ground, from three to six feet.

Those who undertake Daguerreotype portraitures, will of course arrange the back-grounds of their pictures according to their own tastes.

When one that is quite uniform is desired, a blanket, or a cloth of a drab color, properly suspended, will be found to answer very well. Attention must be paid to the tint,—white, reflecting too much light, would solarize upon the proof before the face had had time to come out, and owing to its reflecting *all* the different rays, a blur or irradiation would appear on all edges, due to chromatic aberration. It will be readily understood, that if it be desired to introduce a vase, an urn, or other ornament, it must not be arranged against the back-ground, but brought forward until it appears perfectly distinct on the obscured glass of the camera.

Different parts of the dress, for the same reason, require intervals, differing considerably, to be fairly copied; the white parts of a costume passing on to solarization before the yellow or black parts have made any decided representation. We have therefore to make use of temporary expedients. A person dressed in a black coat, and open waistcoat of the same color, must put on a temporary front of a drab or flesh color, or by the time that his face and the fine shadows of his woolen clothing are evolved, his shirt will be solarized, and be blue, or even black, with a white halo around it. Where, however, the white parts of the dress do not expose much surface, or expose it obliquely, these precautions are not essential; the white shirt collar will scarcely solarize until the face is passing into the same condition.

Precautions of the same kind are necessary in ladies' dresses, which should not be selected of tints contrasting strongly.

It will now be readily understood, that the whole art of taking Daguerreotype miniatures, consists in directing an almost horizontal beam of light, through a blue colored medium, upon the face of the sitter, who is retained in an unconstrained posture, by an appropriate but simple mechanism, at such a distance from the back-ground, or so arranged with respect to the camera, that his shadow shall not be copied as a part of his body; the aperture of the camera should be three and a half or four inches at least, indeed the larger the better, if the object be aplanatic.

If two mirrors be made use of, the time actually occupied by the camera operation varies from forty seconds to two minutes, according to the intensity of the light. If only one mirror is employed, the time is about one-fourth shorter. In the direct sunshine, and out in the open air, the time varies from under half a minute.

Looking-glasses, which are used to direct the solar rays, after a short time undergo a serious deterioration; the foil assuming a dull granular aspect, and losing its black brilliancy. Hence the time, in copying, becomes gradually prolonged.

The arrangement of the camera, above indicated, gives reversed pictures, the right and left sides changing places. Mr. Wolcott, an ingenious mechanician of this city, has taken out a patent for the use of an elliptical mirror for portraiture; it is about seven inches in aperture, and allows him to work conveniently with plates two inches square. The concave mirror possesses this capital advantage over the convex lens, *that the proof is given in its right position, that is to say, not reversed;* but it has the serious inconveniences of limiting the size of the plate, and representing parts that are at all distant from the centre, in a

very confused manner. With the lens, plates might be worked a foot square, or even larger.*

Miniatures procured in the manner here laid down, are in most cases striking likenesses, though not in all. They give of course all the individual peculiarities, a mole, a freckle, a wart. Owing to the circumstance, that yellow and yellowish browns are long before they impress the substance of the Daguerreotype, persons whose faces are freckled all over give rise to the most ludicrous results, a white, mottled with just as many black dots as the sitter had yellow ones. The eye appears beautifully, the iris with sharpness, and the white dot of light upon it, with such strength and so much of reality and life, as to surprise those who have never before seen it. Many are persuaded, that the pencil of the painter has been secretly employed to give this finishing touch.

MISCELLANEOUS.

An Azimuth Cap as an addition to the common Level. By Edward Cowper.—It is sometimes desirable in levelling operations to ascertain the bearing of objects which are either above or below the field of view of the telescope. The common level alone cannot take the bearing of these objects; for, by elevating or depressing the telescope, the action of the compass is destroyed; but, by slipping the Azimuth Cap on to the end of the telescope of the level, objects 50° above or below the field of view may be observed without disturbing the compass or altering the level of the telescope.

This instrument consists of a brass cap, containg two slips of looking glass, placed at an angle to each other, precisely as in Hadley's quadrant; one glass being fixed at an angle to the axis of the telescope, and the other being moveable about a centre. When any object is required to be brought within the field of view, the cap is placed on the end of the telescope, and the angle of the moveable glass is varied until the object is reflected on the fixed glass, and thence to the eye.

Weaving Extraordinary.—One of the most extraordinary specimens of silk weaving ever executed, was exhibited at Mr. Morrison's late conversazione given to the members of the Institute of British Architects. It was a portrait of Jacquard, representing that extraordinary man in his workshop surrounded by his implements, and planning the construction of that beautiful machinery, which now, in its increased perfection returns this testimony to the genius of its inventor. This work worthily entitled "*Hommage á J. M. Jacquard,*" was woven with such truth and delicacy as to resemble a fine line engraving: it was

* The recent experiments of Mr. Wolcott, with the speculum, have produced some very suprising results, of a nature entirely to obviate the objection to its use. Pictures are now obtained with it of an extra large size. Our next number will contain a paper from Mr. W. giving a full detail of the facts in relation to it.—Ed. Am. Repertory.

executed by Didier, Petit and Co. We learned that there were 1,000 threads in each square inch (French,) in both the warp and the woof; and that 24,000 bands of card were used in the manufacture, each band large enough to receive 1,050 holes. Owing to the black threads passing under them, the tone of the highest light was grey, though this was scarcely perceptible. The great difficulty to be overcome was, it is said, the keeping the broad margin round the picture perfectly even in color, and regular at the lines forming the edge of the picture.

Aerial Locomotion.—The Paris papers give accounts of another remarkable invention, the results of which would indeed be of a novel and very important kind, and which would seem to take one more away from the ancient list of impossible problems—that of discovering a fulcrum or *point d'appui* in the air. If this invention be correctly described, there is nothing to prevent balloons being at once adopted in lieu of omnibuses. We shall no longer think it wise to be amongst the sneerers, if perpetual motion and the philosopher's stone should be once more introduced amongst the subjects of human research. M. Eugène de Fresne, the inventor of the apparatus, of which such effects are predicted, has submitted his discovery, to which he gives the name of *Moteur Atmosphèrique,* to the Academy of Sciences, which body has appointed a commission for its examination. The commission is engaged in drawing up a report, and it is observed that the reporter, M. Arago, treats the inventor with great distinction. Meantime the overt experiment, of which the papers have cognizance, is the following:—A few days ago a small group of the learned and noble, which included M. de Chateaubriand, M. de Tocqueville, the Duc de Noailles, and M. Ampère, were assembled on the Quai d'Orsay, watching with great interest the evolutions of a boat of singular construction, which glided up and down the Seine with and against wind and stream, without oars or sails, and having as its sole moving power a sort of aerial wheel, where, in boats hitherto belonging to this lower earth, a sail or a steam-chimney should be. Athenæum.

Windows of Mica.—In the windows of the workshops at the Butterly Iron Works, so much glass was broken by the chippings of iron, that a substitute was sought which should resist a moderate blow, and yet be translucent. A quantity of sheets of mica were procured from Calcutta, which, when fixed into the cast-iron window frames, were found to resist the blow of a chipping of iron driven off by the chisel with such force as would have shivered a pane of glass. Mica possesses both toughness and elasticity, and when a piece of iron does penetrate it, merely a hole is made large enough to allow the piece to pass, while the other parts remain uninjured. It is not quite so transparent as glass, but it is not so much less so to be objectionable; but this circumstance is not important at Butterly, as, in consequence of the quantity of fluoric acid gas evolved from the fluate of lime used as a flux in the blast furnaces, the glass in the windows is speedily acted upon, and assumes the appearance of being ground. Mica is a little more expensive than common glass; but, as its duration promises to be much longer, it must be more economical; and if an extensive use of it could be in-

duced, a more ready supply would be obtained—probably from Pennsylvania or from Russia, where it is commonly used for windows in farm-houses, and also on board ships of war, as it is less liable to be fractured by the concussion of the air during the discharge of heavy artillery. It can be procured of almost any dimensions necessary for ordinary purposes, as it has been found in Russia in masses of nearly three feet diameter. It is susceptible of very minute subdivision, as according to Haüy, it may be divided into plates no thicker than one three-hundred-thousandth part of an inch.—*Mr. Jos. Glynn.*

Trans. of Inst. of Civ. Eng.

New System of Lockage for Canals.—To avoid the present expensive construction of locks and their waste of water, Mr. Smith of Deenston, proposes to divide the canal into a series of basins, the water levels of which should be from 12 to 18 inches above each other. The extremity of each basin is so contracted as to permit only the free passage of a boat; in this is placed a single gate, hinged to a sill across the bottom, the head pointing at a given angle against the stream, and the lateral faces pressing against rabbets in the masonry. The gate is to be of buoyant materials, or made hollow so as to float and be held up by the pressure of the water in the higher level; on the top is a roller to facilitate the passage of the boats. When a boat is required to pass from a higher to a lower level, the bow end, which must be armed with an inclined projection, depresses the gate as much as the depth of the immersion of the boat, and as much water escapes as can pass between its sides and the walls of the contracted part of the basin. The same action takes place in ascending, except that a certain amount of power must be expended to enable the boat to surmount the difference of level between the basins. The quantity of water wasted by each boat would be in proportion to its immersion and the speed at which it passed over the gate. In case of different sized boats passing along the same canal, it is proposed to have a small gate forming part of the main gate, so as to avoid the loss of water which would ensue from the whole width being open for the passage of a small boat. This system has only been tried by models; but it is proposed to make an essay on an extensive canal next summer, when the results will be communicated to the Insitution. Ibid.

Phenomena of Calefaction.—M. Boutigny has read a paper before the Academy of Sciences on Calefaction, by which term he designates the singular phenomenon presented by water when drops of it are thrown upon a very hot metallic surface.

It has generally been supposed that this effect is produced only at a very high temperature, but M. Boutigny find that it occurs in a lead crucible, and consequently below 612° Fahrenheit.

M. Boutigny has observed also that ether gradually dropped into a platina crucible nearly red-hot, calefies as well as water, that is to say, the mass becomes round, without the occurrence of any appearance of ebullition, is afterwards rapidly agitated, and does not seem to wet the crucible. The quantity, however, goes on diminishing, but much less rapidly than if the vessel were cold. During this slow evaporation, a very irritating vapor arises, which does not at all resemble that of ether,

but which in smell greatly resembles aldehyde, and of this the author supposes it to consist; the presence of air appears to be necessary to the production of this vapor. The commissioner to whom M. Boutigny's paper was consigned, made an interesting observation: having immersed a piece of litmus paper into the crucible to try whether the vapor was acid, he observed that the part immersed retained its color, whilst that which was even with the orifice of the crucible became evidently red. The temperature was therefore higher in this place, and it is to be presumed that slow combustion took place analogous to that which occurs in the interesting experiments of Dobereiner.

Anhydrous sulphurous acid presented M. Boutigny with phenomena still more remarkable than ether; he found that when a little of this acid dropped upon a platina capsule heated almost to redness, the drops were strongly agitated, became round, immoveable and opalescent, and seemed even to crystallize. The small spheroid when placed on the hand produced a sensation of cold.

M. Boutigny was of opinion, that in this case the sulphurous acid suffered so great a diminution of temperature that it solidified. The commissioner rejects this explanation, and is satisfied with admitting, that the acid under these circumstances evaporating more slowly than in the open air, produces nevertheless, by this slow evaporation, so considerable a degree of cold as to congeal the moisture of the surrounding air, and to become hydrated. This explanation is apparently confirmed by the fact, that if the small solid globule be rapidly projected into a tube, and it be immediately corked, the globule disappears, but leaving in the place which it occupied a dew, that remains even when the tube is uncorked.

M. Boutigny is of opinion that the phenomena described may be connected with the explosions in steam-boilers, and he is still occupied with the subject, and has made a great number of experiments with different liquids, and particularly with alchohol of different degrees of strength, with ether, oil of turpentine and lemons, and with alkaline and acid solutions. Journal de Pharm.

Detection of Alcohol in Essential Oils.—For this purpose M. Borsarelli employs a small cylindrical tube closed at one end; this is two-thirds filled with the oil, and there are dropped into it small pieces of chloride of calcium, which are quite dry, and free from powder; the tube is then closed, and heated in a water-bath to 212° for four or five minutes, taking care to agitate it occasionally, and to allow it to cool slowly.

If the essential oil contains a notable proportion of alcohol, the chloride dissolves entirely, and forms a liquid stratum, which occupies the lower part of the tube, while the essential collects in the upper. If the oil contains only a very small portion of alcohol, the fragments of chloride of calcium effloresce, lose their form, and unite at the bottom of the tube into a white adhesive mass; when it is quite pure the pieces of chloride suffer no change, even in their form.

It is proper to observe, that in trying an essential oil it is right to employ but a very small portion at first, and to add successive portions gradually; otherwise, if the proportion of alcohol be very small, it

may be absorbed by the chloride without sensibly altering it, and even without showing its presence. It is easy when the operation is over to determine the proportions of a mixture of alcohol and essential oil, by comparing its weight or volume with that of the pure oil which floats upon the alcoholic solution of the chloride.

The same process, the author states, may be employed for determining the quantity of alcohol which ether contains; but the tube should be longer, and not too perfectly closed. Ibid.

Improved Air Thermometer.—At a recent meeting of the Royal Irish Academy, Dr. Apjohn, on the part of Surgeon Grimshaw, drew the attention of the members to a modification of the air thermometer recently devised by the latter gentleman. The objections to the ordinary air thermometer are well known. An idea of Mr. Grimshaw's improvement may be simply conveyed by describing his instrument as a differential thermometer, in the cool ball of which is placed a barometer, while to the side of the same ball a little syringe is attached, by means of which air may be pumped in or out, and the elasticity of the included air thus rendered invariably the same, before the temperature (exhibited upon the scale of equal parts attached to the stem in connection with the hot ball) is registered. Dr. Apjohn observed, that Mr. Grimshaw intended attaching to his thermometer a provision for keeping the barometer vertical; and marking upon this latter instrument two additional points of constant pressure,—one higher, the other lower, than the atmospheric standard,—by the use of which, when necessary, the scale of the instrument may be greatly extended, so as to comprehend with ease the entire of the atmospheric range of temperature.

New Kind of Tin Plate.—M. Brady has formed a superior tin plate of iron and nickel. It is five or six times harder than that now in use, and is very advantageous for culinary utensils, as it does not communicate any color to sauces, which common tin plate frequently does.

Composition of Wool.—Chevreul has lately examined wool with a practical view in dyeing. He has found that wool when washed with distilled water contains at least three immediate principles; 1st, a fatty substance, solid at the ordinary temperature, and perfectly liquid at 140°; 2d, a fatty substance, liquid at the temperature of 59°; 3d, a filamentous substance, constituting the wool properly so called. He has come to this conclusion because the filamentous matter disengages sulphur or hydro-sulphuric acid without losing its essential and characteristic properties, and hence it appears to him probable that the sulphur enters as an element into the composition of a substance quite distinct from the filamentous body.

Getting up the Steam.—Lieutenant Janvier, of the French navy, is said to have discovered a means of getting up the steam of engines with such rapidity, that in ten minutes from the first lighting of the fire, and although the water in the boiler be quite cold, a vessel may be set in motion. This is, it is added, to be accomplished without any additional apparatus, and at very little expense.

A Newly Invented Planing Machine.—On visiting the Polytechnic Exhibition, Newcastle, a few days ago, we were much amused at witnessing the operations of what appeared to be a little model of a planing machine on a new plan, and we followed its backward and forward motion with a great deal of interest; when, after a very short space of time, we were not a little suprised at the precision and quantity of work performed; and we discovered by a brass plate, that, instead of being merely a model, it was in fact, a new working planing machine, recently introduced into the mechanical work-shop by a Mr. John Roberts, of Manchester. It is so simple in its construction and so portable in its dimensions, that it may be laid on the vice-bench, and set to work either by a motion from a steam engine or by hand, and so useful that one man with it can do the work of three men at the vice. The principal novelties in the invention are—the tool, which cuts both ways—and the extreme facility with which anything to be planed may be fixed in the machine. It may very appropriately be termed a self-acting mechanic, and does credit to the mechanical talents of the ingenious inventor, Mr. Roberts. Port of Tyne Pilot.

Discoveries in Cryptogamic Vegetation. From a lecture delivered before the Philosophical and Literary Society of Bristol, Eng.—The first point brought by Mr. Carpenter under the notice of his auditors, was the vegetable nature of *yeast*. He stated that the phenomena of fermentation had long been a source of perplexity to chemists; a change being produced by the action of this substance in the fluid with which it is mixed, whilst it does not itself enter into any new combination, but, on the other hand, is greatly increased in amount. This mystery is now explained. On looking at *yeast* with a good microscope, the mass is found to consist of a number of minute disconnected vesicles, which greatly resemble those of the *red snow*. (Protococcus nivalis.) These, like seeds, retain their vitality for almost any length of time; their power of growing, when placed in proper circumstances, not being destroyed by exposure to such extremes of temperature as 76°, and 212°, or by being dried into a cake. When these are placed in a saccharine solution, they commence vegetating actively, provided the temperature be sufficiently high. If a fluid thus excited to fermentation be examined at short intervals, it is observed that each vesicle puts forth one or more little prolongations, or buds, which in time become new vesicles like their parents; these again perform the same process, so that within a few hours the single vesicles have developed themselves into groups of four, five, or six. By the time that five or six vesicles are found in each group, the fermentation is sufficiently advanced for the purposes of the manufacturer, and he then takes measure to check it. The vegetation of the yeast is then suspended; and the groups of vesicles separate into individuals, the mass of which constitutes the yeast thus largely increased in amount. The vesicles multiply also by a process analogous to the formation of seed in the higher plants. Some of them are observed to burst, and to emit a number of minute gramules, each of which developed itself into a new cell, as in the case of the red snow. It is well known that various fungi, in process of growth, hasten or even effect the decomposition of the substances on which they

vegetate. Thus the common *mould* is well known to destroy the palatibility of sweet preserves; and the *dry-rot* causes the decay of the timber it infests. This tribe of plants, which cannot flourish except upon decomposing organized matter is an exception to the general rule of the vegetable kingdom, the members of which remove more carbon from the atmosphere than they impart. Like other fungi, the simple but important plant, which constitutes yeast, decomposes the organic matter in which it developes itself, and abstracts a portion of the carbon of the sugar, thus converting it into alcohol. It may be expected that the knowledge of the real nature of the process will give the brewer more control over it, when the various causes which accelerate or retard the growth of the vegetable shall have been properly investigated.

Another curious example of cryptogamic vegetation has been lately discovered in an equally unexpected quarter. The disease termed muscardine, which has annually destroyed a large proportion of the broods of silk-worms reared in the South of Europe, has been ascertained to be caused by the growth of a minute vegetable of the fungus tribe within their bodies. When any of the germs have found their way beneath the skin, they vegetate in the fatty mass which covers the body, and gradually cause the death of the animal, by destroying this, and by blocking up the respiratory passages. The plant not only grows from the spot where it has originated, but the new germs which are then produced are carried into distant parts by the current of the circulation. It much resembles, in its first stage, the vegetable of the yeast just described; but it subsequently assumes a more complex form. The disease may be communicated by inoculation, that is, by artificial insertion of the germs of the fungus, to either caterpillar, chrysalis, or moth; but only the first is spontaneously attacked by it, and this when it is about to pass into the pupa state. The germs are probably carried in the air from one to another, and introduced throughout the respiratory openings. The importance of this disease has led to careful inquiry into the circumstances which favor the production of the fungus; and it has been shown, that if the bodies of the caterpillars which have died during breeding be thrown together in heaps, and exposed to the influence of a warm and moist atmosphere for a few days (as was very commonly done,) this fungus almost certainly appears upon them; and that it is then propagated to the living worms by the diffusion of sporules through the air. Bristol Mirror.

Optical Phenomenon.—The following phenomenon may be produced by means of concave mirrors:—Place two concave mirrors together in such a manner that their optical axes intersect each other reciprocally, and put before one of them any object, a red ball for instance, in such a situation that the mirror reflects the image to the place where its axis meets with the axis of the other mirror. Place before the second mirror a different object, a green ball for instance, in such a manner that its image exactly strikes the place where the axes cross each other. If the observer then directs his attention towards the first mirror, and looks along the axis of it, he will perceive the image of the red ball; directing his eye towards the axis of the second mirror, he

will see the image of the green ball previously in the same place where he had before seen the red ball. This experiment plainly shows the manner in which the luminous rays, proceeding from two different objects, can cross each other reciprocally, without experiencing the slightest alteration. Herschel on Vision.

Manufacturing Tea.—The leaves of black tea are the souchong and pouchong. After they have been gathered and dried in the sun in the usual way, they are beaten and put away four different times; they are then put into baskets, pressed down, and a cloth put over them. When the leaves become of a brownish color by the heat, they throw out and have a peculiar smell, and are then ready for the pan, the bottom of which is made red hot. This pan is fixed in masonry breast high, and in a sloping position, forming an angle of forty degrees. Thus, the pan being placed on an inclined plane, the leaves, when tossed about in it, cannot escape behind or on the sides, as it is built high up, but fall out near the edge close to the manufacturer, and always into his hands, so as to be swept out easily. When the bottom of this pan has been made red hot by a wood fire, the operator puts a cloth to his mouth to prevent inhaling any of the vapor. A man on the left of him stands ready with a basket of prepared leaves; one or two men stand on his right with dollahs, or shallow baskets, to receive the leaves from the pan, and another keeps lifting the hot leaves thrown out of the pan into the dollah, that they may quickly cool. At a given signal from the Chinaman, the person with the basket of prepared leaves seizes a handful, and dashes it as quick as thought into the red hot pan. The Chinaman tosses and turns the crackling leaves in the pan for half a minute, then draws them all out, by seizing a few leaves in each hand, using them by way of a brush, not one being left behind. They are all caught by the man with the dollah, or basket, who, with his disengaged hand, continues lifting the leaves, and letting them fall again, that they may quickly cool. Should a leaf be left behind in the pan by accident, the cloth that is held ready in the mouth is applied to brush it out; but all this is done as quick as lightning. The man that holds the basket of leaves watches the process sharply; for no sooner is the last leaf out of the pan, than he dashes in another handful, so that to an observer at a little distance, it appears as if one man were dashing the leaves in, and the other as fast dashing them out again—so quickly and dexterously is this managed. As soon as one basket has received about four handfuls of the hot leaves from the pan, it is removed, and another basket placed to receive the leaves; and so on, until all is finished. A roaring wood fire is kept up under the pan to keep the bottom red hot, as the succession of fresh leaves tends greatly to cool the pan, which ought always to be scrubbed and washed out after the process is over. In China, these pans are made of cast iron, and if great care is not taken, they will crack in the cooling; to prevent which, one man keeps tapping the inside of the edge of the pan briskly with a wet broom used in the cleansing of the vessel, while another pours cold water in gently; thus it cools in a few seconds, and is ready for another batch of tea. The leaves are rolled and tatched the same as other teas, and put into the drying basket for about ten minutes.

When a little dry, people are employed to work and press the leaves in the hands in small quantities, of about one and a half to two rupees weight at a time, for about half a minute; they are then put into small square pieces of paper rolled up; after this they are put into the drying basket, and permitted to dry slowly over a gentle fire for some hours, until the whole is thoroughly dry. This tea is not sold in the China market, it is used principally as offerings to the priests, or kept for high days and holydays. It is said to be a very fine tea, and there is not one man in a hundred who can make it properly. The pouchong tea is made in the same way as the sychee, with this exception, that it is not formed into balls. Bruce's Report, &c.

Absorption of Azote by Plants during Vegetation.—M. Boussingault has determined, by numerous experiments, made with great care, that, while shooting, wheat and trefoil neither increase nor diminish the portion of azote which analysis shows them to contain; and that, during germination, these grains lose carbon, hydrogen, and oxygen; and that each of these elements, as well as the proportions in which the loss occurs, varies at different stages of germination. It appears also, that, during the cultivation of trefoil in soil absolutely deprived of manure, and under the influence of air and water only, this plant acquires carbon, hydrogen, oxygen, and a quantity of azote, appreciable by analysis: wheat, cultivated exactly in the same circumstances, also takes from the air and water, carbon, hydrogen, and oxygen; but analysis does not prove that it has either lost or gained azote. Philos. Mag.

Self-Purification of the Atmosphere.— It is a character of gases, that when once mixed, they have no tendency to arrange themselves according to their specific gravities, as liquids do. The law of Prof. Graham expresses the mode in which this mixture is made :—Suppose two gases to be brought in contact; then they have a tendency to mix, or *diffuse* as he expresses it, depending on their specific gravities, or being inversely as the square root of this law. It is this beautiful law which prevents the atmosphere of cities from becoming dangerously unwholesome. The certainty and rapidity of its operation has been well illustrated by Dr. Thomson, *(Heat and Electricity, p. 236.)* Every individual by breathing, at an average, throws 10⅔ cubic feet of carbonic acid gas into the air in 24 hours. If the population of Glasgow be 260,000, the quantity of carbonic acid thrown by it into the atmosphere would, in 24 hours, amount to 2,773,333 cubic feet; if we admit the other animals, horses, &c. to amount to 1-10th of 260,000, they would produce about 280,000 cubic feet more; so that the whole carbonic acid produced in Glasgow by breathing in 24 hours is 3,053,333 cubic feet. If we suppose the consumption of coals in Glasgow and the neighborhood to amount daily to 2000 tons, this will produce 1,078,510 cubic feet of carbonic acid, so that the whole carbonic acid gas thrown into the atmosphere in Glasgow daily must amount to 4,131,843 cubic feet. Every volume of carbonic acid gas produced renders five volumes of air unfit for respiration; hence in 24 hours, 20,659,215 cubic feet of air are rendered unfit for respiration, or, in fact, perfectly poisonous. Now, a base of four square miles, with a height of 100 feet, contains

11,151,360,000 cubic feet, of which 2,230,272,000 cubic feet are oxygen gas; consequently, in little more than 539 days, the whole oxygen in that space would be converted into carbonic acid gas, and every creature in Glasgow and its environs would be destroyed. Yet, if we examine the atmosphere of Glasgow or its neighborhood, we find it always to contain the usual quantity of oxygen gas, and the proportion of carbonic acid never exceeds 1-1000th of its volume; a proof that both the carbonic acid and azote of the air are dissipated with extreme rapidity.

Athenæum.

DESCRIPTION OF AMERICAN PATENTS

Granted from August 12th to Sept. 10th, 1840.

Machine for cutting the Teeth of Circular Saws. By ELEAZER CARVER, Bridgewater, Mass. Aug. 12th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the machine above described, consisting in a combination of the said several parts, for giving a regularly intermitted motion to the circular saw plate, and for holding the same still and steady in the intervals of motion, and of the parts for cutting the teeth.

Machine for Filing or Smoothing the Teeth of Saws. By ELEAZER CARVER, Bridgewater, Mass. Aug. 12th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the machine above described, consisting in a combination of the said several parts, for giving a regularly intermitted motion to the saw plate, and for holding the same still.

Improvement in the Machine for sawing stuff Circular. By THOMAS KENDERDINE, Horsam, Pa. Aug. 12th.

CLAIM.—But what I do claim, and desire to secure to myself by letters patent, is the use of the guide-rod N, N, passing through the sides of the saw-frame, which is to be made adjustible, so as to adapt it to different curves, substantially in the manner set forth.

Improvement in the Screw Wrench. By STEPHEN KANE, THOMAS and JAMES KEANE, New-York. Aug. 12th.

CLAIM.—We do not claim to have invented a screw wrench, but we claim as new and of our own invention the mode of constructing the moveable jaw, by combining therewith a revolving screw whose threads work into worm teeth cut into the edge of the wrench-handle, substantially as such mode is herewith before described and set forth.

Improvement in the Machine for Sawing and Splitting Timber. By JOHN P. McDOWELL, Summit, Pa. Aug. 12th.

CLAIM.—What I claim as my invention, and which I desire to secure by letters patent, consists in the before described combination and

arrangement of the machinery for sawing with the machinery for splitting logs and other materials.

Improvement in the Alarm Lock for Doors, to prevent Burglary. By DAVID EDWARDS, McConnellsville, Morgan co. Ohio. Aug. 12th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the combination of an alarm with a door or other lock, by means of the dog and spring attached to the bolt, as herein before described. I also claim the combination of the dog K, the ratchet-wheel G, and the catch M, in combination with the spring-wheel C, the pinion E, the spring L, the escape-wheel H, the pallets R, the hammer and handle Q, and the bell P, for the purposes and in the manner herein before described.

Improvement in the Machine for boring and mortising in Chair Seats, Legs, and Arms. By WILLIAM L. HARLEY, Chagrin Falls, Ohio. Aug. 12th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is—

1. The construction of the bit with cutters on the end, and teeth in the side, in combination with the twist, for the purpose and in the manner described.

2. The combination of the two carriages, the lower one resting upon a stationary frame, and moved in it lengthwise by a lever to give depth to the holes and mortises to be bored, and the upper one moved transversely by a crank to give length to the mortises, as described.

3. The construction of the frame for the seats to rest on, so as to be presented obliquely to the bit, in combination with the lower carriage, as described.

4. The construction of the frame for the legs to rest on, to be presented obliquely to the bit, in combination with the lower carriage, as described.

Improvement in the apparatus for blowing Forges and Furnaces. By JAMES A. STEWART, Springfield, Rochester co. Tenn. Aug. 17th. Antedated July 1st.

CLAIM.—What I claim therein as constituting my invention, and desire to secure by letters patent, is the placing of two or more fan-wheels upon the same shaft, but within separate compartments, combined and connected with each other in the manner herein set forth.

Improvement in Smut Machines. By JOHN BURCH, Millport, Chemung co. N. Y. Aug. 22d.

CLAIM.—What I claim therein as constituting my invention, is the combination of the revolving cylinder, with its perforated surface and triangular ribs, with the revolving beaters placed on a shaft in the axis of said cylinder, so as to constitute a grain-cleaning or smut machine; constructed and operating substantially in all respects in the manner herein set forth.

Improvement in the mode of constructing Railway Tracks, or Rails to enable Cars to turn short curves. By HENRY M. NAGLEE, Philadelphia. Aug. 22d.

CLAIM.—What I claim therein as constituting my invention, and desire to secure by letters patent, is the manner of forming the outer rails of such curves with the projection B, and the inclined plane D, in such manner and in such proportion to the flanch and tread of the wheel, and the curvature of the rails, as that they shall coöperate in the manner set forth in producing the effect herein fully described; the inner rail in this case being one of the ordinary kind, and a grooved or guard rail not being necessary, or indeed admissible.

Improvement in the Dredging Machine. By WM. EASBY, Washington, D. C. Aug. 25th.

CLAIM.—What I claim as my invention, and which I desire to secure by letters patent, consists in the arrangement of the barrels on the perpendicular shaft for winding and unwinding the main chains, in combination with the vertical sliding bolt and lever for throwing the barrels in and out of gear, with the shaft by which the scoop or bucket is alternately raised, lowered and drawn back, whilst the animal by which the main shaft is turned continues to travel round on the circular tracks without interruption, as before described. Also, the combination and arrangement of the parallel guide-poles, chains and windlass for raising the scoop, so as to draw it back to its proper position, as before described; and this I also claim in combination with the scoop and the apparatus for disengaging the drop or shutter to discharge the load, as described. I also claim the arrangement of the wings of the horse track, which can be raised, and thereby reduce the width of the machine, so that it may pass through a canal lock or any other narrow place, as before described.

Improvement in Threshing Machines, for conducting the Straw and Grain from the Thresher. By LUTHER WHITMAN, Winthrop, Me. Aug. 25th.

CLAIM.—What I claim as my improvement, and for which I ask an exclusive right, is the combination of the endless belt of slats, constructed as herein set forth, with the inclined plane E, E, and straw carriers F, F; the whole being so arranged that the belt D, while it conveys the straw from the thresher, carries the grain also with it up the inclined plane, in the manner herein described.

Improvement in machines for planting Corn, &c. By SAMUEL W. COLE, Chelsea, Mass. Aug. 25th.

CLAIM.—1. Constructing the dropping cylinder with changeable slides, and forming receptacles in the same for receiving the seed from the hopper; also, *the mode of adapting* the lower part of the hopper to the apertures in the end of the slides, by forming it with chutes in the manner set forth, so as to better conduct the seed to the receptacles in the slides; the whole being arranged and operating substantially as above described.

2. I claim the mode of compressing or regulating the stiffness of the

brush x, (which makes part of the hopper) by means of the clamp and screw, in combination with the hopper and dropping cylinder.

Improvement in Cooking Stoves. By Samuel W. Cole, Chelsea, Mass. Aug. 25th.

Claim.—I claim the particular mode of adapting the circular shelf to the oven, and adjusting the same by means of screws passing up through the bottom plate; also, the furnace, constructed with an exterior casing or cylinder, for the purpose of causing the heat radiating from the outer surface of the furnace to pass downwards, and escape near the bottom of the oven, thereby causing it to be first distributed under the rising shelf, at whatever height the same may be in the oven; the whole being arranged and operating substantially in the manner and for the purposes above described.

I claim the combination of the circular shelf, with the oven and furnace, the furnace being so arranged in the oven that the shelf shall entirely surround it.

Improvement in Puddling Furnaces for manufacturing Iron with Anthracite Coal. By Thomas Cooper, N. York. Aug. 25th.

Claim.—What I claim as my invention, and desire to secure by letters patent, is constructing the floor or bottom of the fire-chamber with a grate in the centre, as set forth, surrounded by a dead work for protecting the brick work of the chamber, all as described. Also, constructing the furnace with a vertical *descending* flue, in the manner and for the purpose set forth. Lastly, I claim combining two or more furnaces, constructed with grates and dead work, and having a descending flue, all as described.

Improvement in Seed Planters. By Joseph Gibbons, Adrian, Lenawee co. Mich. Aug. 25th.

Claim.—What I claim as constituting my invention therein, and desire to secure by letters patent, is the manner in which I regulate the capacity of the cavities made for receiving and conveying the seed to be planted or sown, by surrounding the cylinder in which said cavities are made by a tubular casing adapted thereto, in the manner described, so that giving a partial revolution to said casing, the cavities may be enlarged or diminished at pleasure. I also claim the manner of constructing and using said machine, so that by bearing upon the handle or handles at the back part thereof, the roller will operate as a fulcrum and the distribution of the seed will be arrested.

Improvement in Card Printing Presses. By Samuel Orcutt, Boston, Mass. Aug. 25th.

Claim.—What I claim as constituting my improvements, and desire to secure by letters patent, is—

1. The manner in which I have connected and combined the lever and toggle with the frisket, the inking drum and inking rollers, so that by the depression and elevation of said lever the frisket shall be carried under the platen, the inking apparatus be brought into operation, and

the frisket moved out after the impression has been made, all as herein set forth.

2. I claim the general arrangement of the respective parts of the frisket for holding the card, in combination with the apparatus for dropping the card by withdrawing the parts upon which it is supported, by means of the angular catches or triggers and their appendages. The other parts described I do not claim, as many if not all of them have been previously used in other forms.

Improvement in Franklin Cooking Stoves. By Reuben B. Houghton, Clarkson, N.Y. Aug. 25th.

Claim.—What I claim as my invention, and which I desire to secure by letters patent, consists in the arrangement of the turning grate G, for changing the position of the fire, in combination with the vertical plate P, and dampers K L, for changing the draft, as before described.

Improvement in Electro-Magnetic Machines, &c. By Truman Cook, New-York. Aug. 25th.

Claim.—What I claim therein as constituting my invention, and desire to secure by letters patent, is:

1. The arranging of the armatures B B upon a cylinder or drum, in combination with the pairs of electro-magnets so situated as that the negative and positive pole of each individual magnet shall at the same moment be over two contiguous armatures, in the manner herein fully set forth, and represented in the accompanying drawing.

2. I claim the mode of interrupting the galvanic circuit by means of the cams or notches on the axis of the cylinder operating the wires which dip into the cups of mercury as set forth, in combination with the stationary magnets and revolving armatures, arranged and constructed as herein described.

3. I claim the galvanic battery herein described, composed of separate and distinct plates communicating with cups of mercury, in the manner and for the purpose herein set forth, in combination with the electro-magnetic apparatus, consisting of stationary magnets and revolving armatures, constructed and operating in the manner herein described.

Improvement in the Machine for Carding or Picking Curled Hair. By Francis Harding. Aug. 25th.

Claim.—What I claim therein as constituting my invention, and desire to secure by letters patent, is the combining of the revolving and stationary cards, arranged, constructed and operating substantially in the manner set forth; and in combination therewith, I also claim the revolving cylinder of brushes, also constructed as above described.

Improvement in Chairs. By Matthew W. King, New-York city. Aug. 25th.

Claim.—I do not claim to have invented the before described separate parts of the revolving accommodating seat; but what I do claim as my invention, and which I desire to secure by letters patent, is the

combination of the revolving with the jointed spring-seat, as before described. I also claim the mode of making the spring back and arms by means of metallic spring bars or rods, as described.

Improvement in Cotton Presses. By Fowler M. Ray, Catskill, N. Y. Aug. 25th.

Claim.—What I claim as constituting my invention therein, and desire to secure by letters patent, is the using of the arms D, projecting out at right angles from the shaft C, and having ropes or chains attached to them, which pass over pulleys and raise the follower of the press; the respective parts being combined, connected and operating substantially as herein set forth. I do not claim the manner of constructing and applying the capstan and windlass to my press, although I believe that there is novelty in their mode of construction and operation; nor do I claim any of the other parts described, when taken alone; but I limit my claim, as above, to what I consider to be the distinguishing feature of my press; and this part or arrangement of parts I claim, whether constructed precisely in the form and manner described, or in any other which is substantially the same.

Machine for grinding Apples and other Fruit. By Thomas J. Wells, New-York. Aug. 25th.

Claim.—What I claim as my invention, and desire to secure by letters patent, is the mode above described of crushing apples or other fruit by the action and combination of the two conical disks D, combined with the lever and pulley.

Improvement in the Elevated Ovens of Cooking Stoves. By W. A. Arnold and P. P. Williston, Northampton Mass. Aug. 25th.

Claim.—What we claim therein as our invention, and desire to secure by letters patent, is the enlarging of the capacity of the flue which surrounds the oven at its lower side, and diminishing it on the sides and top, in the manner and for the purpose herein shown. The other parts described we do not claim, but limit ourselves, as above stated, to the construction of the flue, by which a new and useful result is attained.

Improvement in the process of Tanning. By A. H. Buzzell, North Bridgewater, Me. Aug. 25th.

Claim.—What I claim in the above process as my invention, and desire to secure by letters patent, is the mode of tanning hides by placing them, when raised, in a decoction of bark or other liquor containing tannin; and after they have remained there a suitable time, as herein specified, adding an alkali to the liquor, as herein set forth.

Improvement in the Camphine Lamp. By Michael B. Dyott, Philadelphia. Aug. 25th.

Claim.—What I claim as my invention, and desire to secure by letters patent, is not an exact proportion or number of burners, or the particular mode of disposing or placing them in any peculiar form or

situation; but I claim the mode described of regulating the draught by means of a moveable plate which sustains the glass chimney, and otherwise being constructed and operating as set forth and described in the above specification.

Improvement in the apparatus for obtaining Casts from the Teeth and Gums, and the mode of adjusting the Casts when taken. By DANIEL T. EVANS, Philadelphia. Aug. 28th.

CLAIM.—First, the manner of constructing the mouth mould without a dividing plate, so as to admit of the meeting of the teeth, and of their lapping over each other in taking the impression, as herein set forth.

2. I claim the manner of constructing and combining the apparatus of plates for receiving and holding the casts in plaster from the teeth and gums; said apparatus being furnished with a moveable plate, the action of which is similar to that of the lower jaw in the living subject; the respective parts of said apparatus being constructed, combined and adjusted substantially in the manner herein fully described.

Improvement in the process of manufacturing White Lead. By SMITH GARDINER, New-York. Aug. 28th.

CLAIM.—What I claim therein as my invention, and desire to secure by letters patent, is simply the introduction of carbonic acid and of atmospheric air into closed vessels, in which fragments of or granulated lead is subjected to long continued attrition in water; the introduction of these gases being intended to supply the portion of oxygen and of carbonic acid necessary to convert the nascent sub-oxide of lead into white lead, by which means a perfect combination is effected, and the desired result attained, as herein set forth.

Improvement in machines for hulling Rice, &c. By WARREN GROAT, Troy, N. Y. Aug. 28th.

CLAIM.—What I claim, and desire to secure by letters patent, is the manner of constructing a cylindrical surface of files or of stone, and a yielding and elastic surface or bed, made by the union of caoutchouc and leather, and of employing the said cylinder and bed in connection or coöperation with each other, in the manner and for the purpose as above described.

And also the placing of files, at discretion, between different sections of such elastic bed, and using the same in like connection with the cylinder for like purposes, as above described.

Improvement in the Composition for rendering Leather water-proof, and in the mode of applying the same. By CHARLES F. MILLER, Baltimore, Md. Aug. 28th.

CLAIM.—What I claim therein is the particular compound, composed of materials, and combined in the proportions, or nearly in the proportions, above set forth. And I also claim the manner of applying this compound, and preparing the leather for use, by exposing said leather in an oven properly heated, in the manner and for the purpose herein

made known, in combination with the subsequent process of filling the pores on the flesh-side with Armenian bole, or other absorbent, earthy matter, possessed of analogous properties. I will here observe that the borax is added not on account of its mechanical, but on account of its chemical action on the other ingredients.

Improvements in the Machinery for Tarring slivers or bands of Hemp, and making Oakum of the same. By Wm. Montgomery, Boston, Mass. Aug. 28th.

Claim.—I claim saturating the hemp or sliver by a revolving reel $r\ s\ t\ u$ immersed in the tar; and I also claim, in combination with the reel, the moveable radial arms $f'\ f'$, &c. playing between the double bars $a'\ a'\ b'\ b'$ of the reel, and also the guiding strips of metal $h'\ h'\ i'\ i'$ arranged as described, the said combination being for the purpose herein before described of sliding a part of the roving (as it passes to be immersed in the tar) to the opposite side of the reel, to make way for the portion which comes from the feeding rollers.

Secondly, I claim the combination of the system of the rollers $m'\ n'\ i^2\ k^2\ l^2$, with the reel $r\ s\ t\ u$, arranged substantially as described, the first set $m'\ n'$ serving to press out any superfluous quantity of tar from the sliver; and the second set $i^2\ k^2\ l^2$ being so constructed and operated that the surface of each succeeding roller shall move faster than that which precedes it, which separates and draws out the fibres, and supersedes the necessity of picking, &c.

Lastly, I claim the combination of the curved guides $w'\ w'\ x'\ x'$ (the ends of which are weighted as described) arms $a^2\ a^2\ b^2\ b^2$ (operated by means of the screws on the rods $e^2\ e^2\ f^2\ f^2$ and nuts $c^2\ c^2\ d^2\ d^2$) with the rollers $m'\ n'$, for the purpose of preventing the tar from getting in lumps or masses on the oakum, after it has passed through the said rollers.

Improvement in the mode of heating the Blast for Smelting Furnaces. By Wm. H. Phillips, Brooklyn, N. Y. Aug. 28th.

Claim.—What I claim therein as constituting my improvement, and desire to secure by letters patent, is the combining with the ordinary air-heating apparatus, on the tunnel-head of a blast furnace for smelting iron by means of mineral coal, one, two or more small auxiliary furnaces, into the ash-pits of which air is to be blown, and to be heated by passing through ignited coal, and thence conducted immediately into the heating oven; the whole being connected and combined substantially in the manner and for the purpose above set forth.

Improvement in Steam-Boilers and Generators. By Dudley Marvin and Oran W. Seeley, Sodus, N. Y. Aug. 28th.

Claim.—What we claim therein, and desire to secure by letters patent, is—

1. The manner in which we have constructed and combined the respective parts of our boiler or steam generator with each other, as above described; that is to say, we claim the formation of the water cells, consisting of one which surrounds the three sides of what we have denominated the principal casting, extending down to the lower edge

of said casting, and having three or any preferred number of water cells intermediate between the cells at the sides of the principal casting, said intermediate cells extending down so far as to leave the requisite space for the fire-chamber, and having spaces between them which are to be converted into reverberating flues, by means of partition or division pieces, located and operating in the manner herein set forth.

2. The forming or making of that part which we have denominated the principal casting in one single piece of cast-iron, by giving to the respective parts thereof the designated taper, and otherwise constructing the pattern in the way described, so that it will draw from the mould, and may be cast in a single pair of flasks without the employment of cores.

3. It is to be distinctly understood that although we have given specific directions for forming the respective parts of our boiler, we do not intend to limit ourselves to the precise form and number of parts, but to vary these as we may think proper, whilst we attain the same end by means substantially the same. It may be found convenient, for example, to cast the bars of the division piece separate from each other, instead of connecting them to a front piece to which the door is hinged. This we give as an example of changes that would not alter the real construction or mode of action.

Improvement in the construction of Molasses Gates. By AMMI WEST, Green, Kennebec co. Me. Aug. 28th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the mode herein described of tightening the cap upon the inner tube, by making them of a tapering or conical form, and connecting them by a set screw, in the manner set forth in my specifications, so that when the cap is screwed down upon the inner tube, it shall, owing to the conical form I have given the cap and tube, be made to embrace the latter more closely, and thus prevent leakage as the parts wear away.

Improvement in Saw-Mill Dogs for setting Logs. By MARTIN RICH, Ithaca, N. Y. Aug. 28th.

CLAIM.—What I claim therein as constituting my invention, is—

1. The manner in which I have constructed and arranged the improved dog, as set forth; namely, the giving to it the form of a quadrangular frame, furnished with teeth on one side, and sliding through an opening or mortise, in a standard affixed to or making a part of a sliding plate and rack by which the log is carried in setting; said dog being held in the required position by a screw or wedge.

2. The arrangement and combination of the parts concerned in the log by the return motion of the carriage; said combination consisting of the shaft H with its right and left-handed screws, the cog-wheel on its end, and the vibrating bar for throwing the rack Q into and out of gear, operating substantially in the manner set forth.

3. In combination with the log-setting apparatus, the manner of constructing the rack Q with moveable teeth, for the purpose herein fully made known.

Improvement in the mode of channeling and scarfing the soles of Pumps, Shoes, &c. By Lewis Baker, Fort Plain, N. Y. Sept. 2d.

Claim.—What I claim as my invention, and which I desire to secure by letters patent, consists in the combination of the cutting instruments with the form, as before described.

Improvement in the Machine for Boiling and Washing Rags for manufacturing Paper. By George Spafford, Windham, Ct. Sept. 2d.

Claim.—What I claim as constituting my invention, and desire to secure by letters patent, is *first*, the construction and use of a cylindrical revolving boiler and washer, the interior of which is divided into four or any other convenient number of compartments by grated partitions, within which the rags are to be subjected to the action of high steam and of an alkaline solution, in the manner and for the purpose herein set forth; the whole being constructed and operating substantially in the manner described.

Improvement in the Machine for Cutting Staves. By Isaac Hosmer and Wm. P. L. Badger, Concord, Mass. Sept. 2d.

Claim.—We claim the method of shifting the axis of vibration without changing the position of the knife, by means of the moveable standards, in combination with the shaft or arbor, and the slots in the radial arms, as herein described.

Improvement in the Machine for making Stove-Pipes, Mouldings, Conductors, Eave-Troughs, &c. By John Farrar, Cuyahoga, Summit co. Ohio. Sept. 2d.

Claim.—What I claim as my invention, and desire to secure by letters patent, is the employment of a roller or cylinder with a groove, in combination with a concave bed for making mouldings, conductors, eave-troughs, stove pipes, &c. as herein described.

Improvement in the Machine for making Rivets. Patent to issue to Alpheus Fobes, (assignee of Charles Lyon;) Fitch W. Taylor, (assignee of Alpheus Fobes, assignee of Smith Gardner, assignee of Charles Lyon.) New-York. Sept. 2d.

Claim.—What I do claim therein as original, and desire to secure by letters patent, is:

1. The particular manner in which I have combined and arranged the parts constituting what I have denominated the open die-plate, and its immediate appendages; that is to say, I claim the combining of the slide *b*, *b*, with the sliding half *d*, of the die, and with the die-plate I, and with the wedge F′, so that the respective parts may be operated upon in the manner and for the purpose herein set forth.

2. I claim the manner in which I have arranged and combined the feeding apparatus as herein set forth, intending by this arrangement and combination, the manner of operating the feeding rod O O, by a cam or a pin on the main shaft, and of operating the feeding tongs by means of the stud R on the opposite end of said rod; the stud R closing the tongs, and moving them back and forth by its action against the offsets thereon; all constructed and operating as herein made known.

Improvements in the machinery for making Hook or Brad-headed Spikes. By HENRY BURDEN, Troy, N. Y. Patented Sept. 2, 1840. Antedated March 2, 1840.

CLAIM.—What I claim, therefore, in the above described machine as constituting my invention, and which I desire to secure by letters patent, is the bending of that portion of the end of the spike-rod from which a hook or brad-headed spike is to be formed, by means of what I have denominated the bending lever, or by some analogous device, operating substantially in the manner and for the purpose herein set forth; and in combination therewith I also claim the so forming of the heading die, and of the parts of the gripping dies within which the bent part is to be upset, as to give the proper shape to the hook or brad-head to be thus formed.

Improvement in the Machine for Cutting Veneers. By JOHN DRESSER, Stockbridge, Mass. Sept. 3d.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the particular manner of cutting veneers with a knife from cylindrical blocks of timber, revolving in a common turning-lathe or other similar machine as herein set forth.

Improvement in Railroad Switches. By NATHANIEL EATON, Worcester, Mass. Sept. 3d.

CLAIM.—What the said Eaton claims as his invention, and desires to secure by letters patent, is the mode of constructing switches with a moveable rail, operating by a spring or weight, or otherwise adjusted in the manner before described, so as to cover two or more permanent railroad tracks.

Improvement in the mode of connecting Steam-Boilers, and supplying Water to the same. By CADWALLADER EVANS, Pittsburg, Pa. Sept. 3.

CLAIM.—What I claim therein, and desire to secure by letters patent, is the placing of the pipes of communication between the respective boilers in the same tier, on board of steam-boats, at a point above the level of the tops of the contained flues, so that the water cannot flow from one to the other below the requisite water line, and thereby expose the tops of said flues; and in combination therewith I claim the manner of arranging the supply tubes so as to force the water into the outside of the boilers only. I also claim the arrangement of the valve in the careening, as directed to the most elevated boiler, whether the same be effected in the manner proposed, or in any other which is substantially the same.

Improvement in the mode of ascertaining the Quality of Lamp Oil. By JOHN W. HARRIS, Dorchester, Mass. Sept. 3d.

CLAIM.—What I claim as my invention is the construction of the oleometer scale, also the mode of ascertaining the quality of spermaceti oil at any particular temperature by means of the aforesaid scale, in combination with the oleometer and thermometer, as herein set forth. I disclaim as my invention the oleometer itself.

Improvement in machines for separating Garlic from Grain. By Wm C. Grimes, York, Pa. Sept. 3d.

Claim.—What I claim as new and as my invention, and desire to secure by letters patent, is the mode of separating garlic and other foreign matter from wheat and other small grain, by means of the combined action of a hollow radial chambered wheel, and a series of rings revolving in connection with, or remaining fixed around it, as herein set forth; the rings forming a narrow wedge-shaped groove, into which the grain, garlic, &c. is thrown by the radial wheel, when the separation ensues, as before described.

Improvement in the Paper Engine. By Wm. Dickinson, Worcester, Mass. Sept. 3d.

Claim.—What I claim as my invention is the art of raising and lowering at pleasure, and to any desirable extent, the whole of the roller and shaft of the paper engine, so that the knives or bars in the roller, and the steel bars or plates in the bottom of the vat shall always be parallel, or nearly so, and the space between them as nearly equal from one end to the other as desirable; and this is done by means of the application and combination of machinery above described.

Improvement in the construction of Flower Pots or Vases for Plants, &c. By Joseph Adams, Boston, Mass. Sept. 3d.

Claim.—Having thus described my improvements, I shall claim as my invention a cistern *g, h, i, k, l, m,* constructed as above described, and having any suitable number of holes in the bottom, in combination with a vase or flower-pot which should be partially filled with water, the whole being constructed and operating substantially in the manner and for the purposes above set forth.

Improvement in Cement for covering Buildings, &c. By Jacob Bump, Kirtland, Lake co. Ohio. Sept. 3d.

Claim.—What I claim as my invention, and desire to secure by letters patent, is a cement composed of the aforesaid material.

The above cement may be shaded with lamp-black.

Improvement in the mode of opening and closing Window Blinds. By George Butterfield, Hopkinton, N. H. Sept. 4th.

Claim.—The invention claimed and desired to be secured by letters patent, is the before described mode of opening and closing window blinds, by the aforesaid combination of bar, racks, pinion, and crank, or any other combination substantially the same, by which they are opened in a similar manner.

Improvement in the Stencil-Plate, or apparatus for marking Boxes, &c. By Edwin Allen, Windham, Ct. Sept. 4th.

Claim.—What I claim as my invention, and which I desire to secure by letters patent, consists in the combination of the perforated plates and frame, as before described, for marking boxes, bales, &c.

Improvement in the Apparatus for transmitting Heat by the Circulation of Hot Water. (Patented by him in August, 1838.) By ANGIER M. PERKINS. Sept. 4th.

CLAIM.—1. The combining of a force-pump with the circulating tubes, arranged and combined as set forth, closed in all parts as herein described, excepting in that for the admission of water from said pump.

2. The supplying the tubes with water by means of a valve opening inwards, within a cistern, constructed and operating substantially in the manner of that represented in Fig. 5, and herein described; the water being thereby allowed to enter said tubes by its own gravity, or by atmospheric pressure, whenever a deficiency arises from either of the causes within enumerated.

3. The combining with said apparatus what I have denominated the expansion or safety valve, for allowing a portion of water to flow out of the tubes when expanded by heat.

4. The employment of a portion of the circulating tubes, of my system of closed tubes, to constitute fire-bars, as set forth; not intending to claim as my invention the using of hollow fire-bars, communicating with a steam-boiler, this having been before done.

5. The manner of using the expansion and contraction of one of the hot-water tubes, in combination with my system of circulating tubes, as a heat governor or regulator, whereby the fire is kept at any required degree of intensity, and the tubes at any required temperature.

Improvement in Machines for Moulding and Pressing Brick. By STACY COSTILL, Philadelphia. Aug. 25th.

CLAIM.—What I claim as my invention, and which I desire to secure by letters patent, consists in constructing the platform with vertical trunks, in the manner described, in combination with the revolving spider.

I also claim the moveable arm *a*, in combination with the revolving plate P, and stationary cam *l*, the arm *a* being connected to the plate P, and revolving with it while the brick is being pressed, and being detached from it as soon as the pressure is completed as described.

Improvement in instruments for delineating Maps, Charts, &c. By AMITY BAILEY, Newbury, Newbury district, S. C. Sept. 4th.

CLAIM.—What I claim as my invention is the combination of the parallel ruler with the revolving ring, and graduated circle containing degrees, and parts and part of degrees marked thereon, as herein set forth, for the purpose of drawing maps, charts, plats of land, architectural plans, and other rectilinear geometrical figures.

Improvement in Inclined Float Paddle-Wheels for propelling Boats, &c. By FRANCIS W. STEVENS, England. Sept. 5th.

CLAIM.—I claim the arrangement of the wheel, and of the floats or propellers, by which their adjustment is effected in the manner and for the purposes before described.

Machine for cutting Grass under Water. By JACOB HINDS, Hindsburg, Orleans co. N. Y. Sept. 5th.

CLAIM.—I do not claim to be the inventor of the sythe; but what I do claim is the connecting of two sythes at their heels, and to a bar of iron, &c. for the purpose and in the manner described.

Improvement in the Door and other Locks. By AUGUST PRUTZMANN, Philadelphia. Sept. 5th.

CLAIM.—What I claim therein as constituting my invention, and desire to secure by letters patent, is the manner in which I have constructed, arranged and combined the slides and safety levers contained within the parts which I have denominated the barrel and bit, so as to be operated upon respectively by the offsets on the end of the key, by which the notch in said levers are made to coincide with the notch in the bit, thus allowing the bit and barrel to be carried round by means of the key, and the spring-bolt to be carried forward, or moved back as a lock-bolt. I also claim the particular arrangement of the parts which operate upon the bolt as a spring-bolt in combination with each other; said combination consisting of the double lever B, acted on by both of the cams or fallers of the respective knobs, said lever acting upon the bolt through the intermedium of the tumbler F; the whole combined and operating substantially in the manner herein set forth.

Improvement in the apparatus for preserving and holding Butchers' Meat in market places. By ADAM SELTZER, Baltimore, Md. Aug. 5th.

CLAIM.—What I claim as my invention, and which I desire to secure by letters patent, consists in the before described combination of the refrigerator, zinc salting tubs, and motive block, for the use of victualers at the market house or other places.

Improvement in Locomotive Cylinder Printing Presses. By CHARLES J. CARR and ANDREW SMITH, Belper, Eng. Sept. 10th.

CLAIM.—The parts of novelty which we claim as secured to us, are:

1. The arrangement and construction of those parts of the machine used for receiving the paper from the delivery table or tables, and giving them to the printed cylinder and guide-tapes or bands, to be conducted through the machine and printed upon, and afterwards delivering the printed sheets from the machine, said arrangement and construction consisting principally of the following: leaf *g* and straps *m*, *m*, in combination with the receiving roller *d*, the whole being constructed and operating as set forth.

2. The improved apparatus, as above described, for distributing the ink taken from the inking-troughs and ductor rollers, said apparatus consisting of the ratchet *a* on the ductor rollers and their appurtenances, arranged and operating as herein set forth.

3. The arrangement and construction of the parts above described for effecting a register, as in book or other work, where such register may be required; said arrangement consisting of the combination of the springs *b*, *b*, with the falling leaf *g*, for liberating the paper from the register points as may be required.

Improvement in constructing Canal Boats in sections, and in the manner of uniting them. By Robert Frazer, Waynesburg, Pa. Sept. 10th.

Claim.—What I claim as my invention, and desire to secure by letters patent, consists:—1. In placing the boats two abreast, as described.—2. The mode of fastening the sections together when floating by the yokes and screws, as described.

Improvement in the Brake for Railroad Carriages. By Petrus J. O. Conway, Philadelphia. Sept. 10th.

Claim.—I do not claim to be the inventor of the brake or drag, in which the shoe presses against the road and the periphery of the wheel at the same time, this having been known and used before; but I do claim as my invention attaching the shoe to the spring-bar, in the manner and for the purpose specified.

Improvement in Spark Arresters. By Leonard Phleger, Philadelphia. Sept. 10th.

Claim.—What I claim therein as constituting my invention, and and desire to secure by letters patent, is the forcing of the sparks to descend between the flue A, A, and the perforated cone, into the space M, and thence through the pipe N, into the spark receptacle O, in the manner and in consequence of the combined operation of the respective parts, constructed substantially as set forth.

I also claim the forming of the flue-space on the outside of the perforated cone, constructed as described, by combining with the space between said cone and the exterior case, a number of pipes or tubes H, H, in the manner and for the purpose herein set forth.

Improvement in Cultivators. By Noah Barnes, Easthampton, N. Y. Sept. 10th.

Claim.—What I claim as my invention, and desire to secure by letters patent, consists in the before described combination of the share, teeth and frame for dressing crops planted in rows, as herein set forth.

Improvement in the manner of applying Alarms to Clocks and other Time-Pieces. By Benjamin Knight, Slatersville, R. I. Sept. 10th.

Claim.—What I claim therein, and desire to secure by letters patent, is the arrangement and combination of the parts as within described, for giving an alarm by means of a bell, either near to or distant from the time-piece; said combinations consisting of the detent upon the minute arbor for raising the rod Q, the said rod, the wheel P, the latch E, and the falling weight B, with their necessary appurtenances; the whole constructed and operating substantially in the manner and for the purpose set forth.

Improvement in the Machine for Cutting Staves. By Cephas Manning, Acton, Mass. Sept. 10th.

Claim.—Having thus described my machinery for cutting staves, I shall claim attaching the knife to curved pieces *a*, *b*, moving in grooves *c*, *d*, as represented in figures 1 and 2, as described.

Improvement in the Machine for dressing Cotton Waste or Rags, previous to their being operated on by the Cutting and Dusting Machinery. By Emery Smith, North Sudbury, Mass. Sept. 10th.

Claim.—I claim the cylinder with angular teeth, in combination with the wires F F, on the inside of the box, and wire grating under said cylinder; the whole being arranged and operating together substantially in the manner above mentioned, and for the purpose of dressing cotton thread or waste previous to its being reduced by the cutting, and subjected to the action of the dusting machines.

Improvement in the Mill for Grinding Sugar. By Nathan Sargent, Cambridgeport, Mass. Sept. 10th.

Claim.—Having thus described my improvement, I shall claim a cylinder having its teeth disposed in advancing and retrograding helices, in combination with a scraper; the whole being arranged and operating together substantially in the manner and for the purposes herein above mentioned and set forth.

Improvement in Glass Knobs for Doors, &c. By Francis Draper, East Cambridge, Mass. Sept. 10th.

Claim.—I shall claim as my invention, connecting the glass knob to the socket, through the intervention of a conical metallic ring affixed to and surrounding the lower part of the knob, and soldered to the socket; the whole being arranged substantially in the manner and for the purposes above set forth.

Improvement in the manner of Pressing and Finishing Bonnets and Hats, and other manufactures of Straw. By William Chaplin, New-York. Sept. 10th.

Claim.—I do not claim to have invented the press herein described, or any of the parts thereof, nor do I claim to have invented the wooden die-blocks herein described; but what I do claim as new, and of my own invention is as follows:

1. The application of countersunk heated metal disks, for pressing and finishing the crown-tops of hats and bonnets, in combination with the die-block, substantially as the same are herein described.

2. The mode of forming the conical matrices and heater boxes with heaters, and the combination of the same with the conical die-block, when such combination is applied to pressing and finishing the sides of bonnet or hat crowns, substantially as herein described.

3. The employment of the conical die-block for pressing the brims or fronts, and also the employment of pasteboard to give equal pressure, substantially as the same is herein described.

4. The mode of forming the conical matrices and heater boxes with heaters, for pressing bonnet or hat fronts or brims, and the combination thereof with the covered conical die-block, when such combination is employed for the purpose of pressing bonnet or hat fronts or brims, or articles of a similar nature made of vegetable substances, substantially as the same are herein described.

Improvement in the Machine for Cutting Staves. By OLIVER SHELDON, New Marlborough, Mass. Sept. 10th.

CLAIM.—I claim as my invention, and desire to secure by letters patent, the cutters for forming the chamfer and groove, and for cutting off the ends of the staves fixed to the revolving arms as herein described, or in any similar manner, combined with the revolving knife for cutting the staves off from the block of timber, as herein described.

LIST OF ENGLISH PATENTS

Granted between the 25th June and 30th July, 1840.

John William Nyren, of Bromley, manufacturing chemist, for improvements in the manufacture of oxalic acid. June 26; six months to specify.

Thomas Spencer, of Manchester, machine-maker, for a certain improvement or improvements in twisting machinery, used for roving, spinning and doubling cotton, wool, silk, flax, and other fibrous materials. June 26; six months.

William Jefferies, of Holme-street, Mile-end, metal refiner, for improvements in copper, spelter, and other metals, from ores. July 1; six months.

William McMurray, of Kenteith Mill, Edinburgh, paper-maker, for certain improvements in the manufacture of paper. July 1; six months.

John David Poole, of Holborn, practical chemist, for improvements in evaporating and distilling water and other fluids, being a communication. July 2; six months.

Charles May, of Ipswich, engineer, for improvements in machinery for cutting and preparing straw, hay, and other vegetable matters. July 6; six months.

Edwin Turner, of Leeds, engineer, for certain improvements applicable to locomotive and other steam-engines. July 6; six months.

James Harvey, of Bazing-place, Waterloo-road, gentleman, for improvements in extracting sulphur from pyrites and other substances containing the same. July 8; six months.

Louis Leconte, of Leicester-square, gentleman, for improvements in constructing fire-proof buildings. July 9; six months.

Joshua Taylor Beale, of East Greenwich, engineer, for certain improvements in steam-engines. July 10; six months.

George Barnett, of Jewin-street, London, tailor, for improvements in fastenings for wearing apparel. July 11; six months.

Joseph Getten, of Paul's-chain, London, merchant, for improvements in preparing and purifying whale-oil, being a communication. July 11; six months.

William Palmer, of Feltwell, Norfolk, blacksmith, for certain improvements in ploughs. July 11; six months.

Peter Fairbairn, of Leeds, engineer, for certain improvements in machinery or apparatus for hackling, combing, repairing or dressing hemp, flax, and such other textile or fibrous materials, being a communication. July 13; six months.

Thomas Tassell Grant, Esq. an officer in her Majesty's victualling yard at Gosport, for improvements in the manufacture of fuel. July 13; six months.

Edwin Travis, of Shaw Mills, near Oldham, Lancaster, cotton-spinner, for certain improvements in machinery, or apparatus for preparing cotton and other fibrous materials for spinning. July 15; six months.

John Lambert, of Coventry-street, St. James, within the Liberty of Westminster, gentleman, for certain improvements in the manufacture of soap, being a communication. July 15; six months.

James Jamieson Cordes and Edward Locke, of Newport, in the county of Monmouth, for a new rotary engine. July 18; six months.

Moses Poole, of Lincoln's Inn, gentleman, for improvements in fire-arms, and in apparatus to be used therewith, being a communication. July 18; six months.

James Roberts, of Brewer-street, Somers-town, ironmonger, for improved machinery, or apparatus to be applied to the windows of houses or other buildings, for the purpose of preventing accidents to persons employed in cleaning or repairing the same; and also for facilitating the escape of persons from houses when on fire. July 18; six months.

Francis Todd, of Pendinnis Castle, Falmouth, gentleman, for improvements in obtaining silver from ores and other matters containing it. July 29; six months.

Alexander Angus Croll, superintendent of the Chartered Gas Company's Works, Brick-lane, for certain improvements in the manufacture of gas, for the purposes of illumination, and for the preparation or manufacture of materials to be used in the purification of gas, for the purposes of illumination. July 29; four months.

John Swain Worth, of Manchester, for improvements in machinery for cutting vegetable substances, being a communication. July 29; six months.

Robert Urwin, of , engineer, for certain improvements in steam-engines. July 29; six months.

List of Patents granted for Scotland, subsequent to the 22*d June*, 1840.

William Neale Clay, of Flimby, Cumberland, gentleman, for certain improvements in the manufacture of iron. Sealed June 25.

Rice Harris, of Birmingham, Warwick, gentleman, for certain improvements in cylinders, plates, and blocks, used in printing and embossing. June 25.

Robert Cook, of Johnston, in Renfrewshire, engineer and millwright, for the making of bricks by machinery, to be wrought either by steam or other power. June 30.

John Hemming, of North Bank, Regent's Park, Middlesex, gentleman, for improvements in gas meters. June 30.

Thomas Richardson, of the town and county of Newcastle-upon-Tyne, chemist, for a preparation of sulphate of lead, applicable to some of the purposes to which carbonate of lead is now applied. June 30.

David Morison of William street, Finsbury, Middlesex, inkmaker, for certain improvements in printing. June 30.

Jonathan Sparke, of Langley Mills, Northumberland, agent, for certain improved processes, or operations for smelting lead ores. July 2.

William McMurray, of Kenteith Mill, near Edinburgh, paper maker, for certain improvements in the manufacture of paper. July 2.

Robert Stirling Newall, of Dundee, Forfar, being partly a communication from abroad, and partly by invention of his own, for certain improvements in wire ropes, and in machinery for making such ropes, which ropes are applicable to various purposes. July 2.

Charles Greenway, of Douglas, in the Isle of Man, Esq. for certain improvements in reducing friction in wheels of carriages, which improvements are also applicable to bearings and journals of machinery. July 2.

John Lothian, of Edinburgh, geographer, for improvements in apparatus for measuring or ascertaining weights, strains, or pressure. July 7.

John Swain Worth, of Manchester, in the county of Lancaster, merchant, being a communication from abroad, for certain improvements in rotary engines to be worked by steam and other fluids, such engines being also applicable for pumping water and other liquids. July 7.

Thomas Peet, of Bread street, Cheapside, London, gentleman, being a communication from abroad, for certain improvements in steam engines. July 10.

Edward Thomas Bainbridge, of Park place, St. James, Middlesex, Esq. for improvements in obtaining power. July 10.

John Juckes, of Shropshire, gentleman, improvements in furnaces, or fire-places, for the better consuming of fuel. July 10.

James Harvey, of Bazing Place, Waterloo road, Surrey, timber merchant, for certain improvements in paving streets, roads and ways, with blocks of wood, and in the machinery or apparatus for cutting, or forming such blocks. July 13.

William Henry Bailey Webster, of Ipswich, Suffolk, surgeon in the Royal Navy, for improvements in preparing skins and other animal matters, for the purposes of tanning and the manufacture of gelatine. July 13.

Alexander Bow, of Crown street, Hutchesontown, Glasgow, Lanark, Scotland, builder, for improvements in furnaces and flues, by the introduction and application of hot air thereto, and for the consumption of smoke and economizing fuel. July 14.

List of Irish Patents, granted in June, 1840.

John Inkson, for improvements in apparatus for consuming gas for the purposes of light.